

DOCUMENTATION OF COMMENTS EXTERNAL INDEPENDENT REVIEW PANEL AND RESOLUTION OF THESE ISSUES BY CORPS IN DECEMBER 2002 FINAL COMPREHENSIVE ECONOMIC REANALYSIS REPORT

1.0 BENEFITS ASSUMPTIONS AND DATA SOURCES

1.1 IMPACT OF DRAFT ON CONTAINER VESSEL ROTATION

Statement of Concern. The previous report confused the operations of the various container lines serving Philadelphia and alleged that existing operations were restricted by draft; that issue has been resolved in the revised reanalysis report.

<u>Corps Response:</u>
Comment noted – issue is resolved.
<u>Panel Conclusion:</u>
Issue resolved.

1.2 ASSUMPTIONS REGARDING CONTAINER VESSEL DEPLOYMENT

Statement of Concern. The description of *current* container vessel rotation in the previous version of the report was incorrect, and confused existing and planned services. That issue has been resolved.

<u>Corps Response:</u>
Comment noted – issue is resolved.
<u>Panel Conclusion:</u>
Issue resolved.

1.3 CONTAINER VESSEL DRAFT SCENARIOS

Statement of Concern. The report alleges, but does not demonstrate, that the port rotation practices for the forthcoming P&O Nedlloyd/Columbus Lines joint container vessel service will be determined by project depth in the Delaware River. The present analysis rests on

an assumed change in vessel rotation for a service that has not yet started, using a string of vessels that have not yet all been built. The essence of the argument is that the joint eastbound round-the-world service of P&O Nedlloyd, Columbus Lines, and others would call at Philadelphia, then Savannah, then Europe in the without project condition, and could call at Savannah first, then Philadelphia in the with project condition, thereby saving roughly 30 hours of time per voyage. While the notion is plausible, the analysis and documentation presented in the report are insufficient to create confidence or form a reliable basis for decision on project benefits. There are no data presented on past, present, or future vessel arrival and departure drafts at either Philadelphia or Savannah. (Anecdotal information on initial voyages of the first Albatross Class vessels is not enough). The issue of container vessel draft and port rotation is significantly more complex than depicted in the report.

Basis of Concern. The report indicates that the planned eastbound P&O/Columbus Line VSA service from Australia/New Zealand is expected to call at Philadelphia first after the Panama Canal, and then call at Savannah to load outbound cargo for Europe. A Panama/Savannah/Philadelphia/Europe rotation would be more attractive and less costly, but loading outbound cargo at Savannah could increase draft beyond the 37 feet currently usable at Philadelphia without riding the tide. This description is reasonable, but incomplete.

Under a plausible operating scenario, the VSA could call at Savannah first without deepening the Delaware River and with minimal impact on scheduling:

- The design draft of the vessels at issue is reportedly 42 feet, but they cannot be loaded to more than 39.5 feet for the Panama Canal. The vessel draft depends on the bunker fuel load as well as the combined stowage of loaded and empty containers. The bunker burn-off between the Australia/New Zealand and the first U.S. port will necessarily reduce the arrival depth to less than 39.5 feet (the Corps has the capability to estimate the draft reduction due to burn-off).
- Assuming a first call at Savannah, departure draft from Savannah (and thus arrival draft at Philadelphia) will be a function of arrival draft (less than 39.5 feet), the weight of discharged cargo, the weight of loaded cargo, and whether or not the vessel bunkers in Savannah. If the vessel does not bunker in Savannah, the arrival draft at Philadelphia will likely be less than 42 feet. A multi-port analysis may be required for an estimate.
- Tides in the Delaware River reportedly favor arriving vessels headed upstream. A brief analysis of readily available information suggests that much of the time the channel would be deep enough to permit transit with 41 feet of arrival draft and 3 feet below the keel (44 feet total).
- Steaming time between Savannah and Philadelphia is roughly 30 hours (677 nautical miles at 23 knots, according to the Container Model). Unless the vessel departs Savannah between 7 AM and 11 AM, it cannot both arrive and depart during the day shift. More than likely, either the departure from Savannah or the arrival at Philadelphia will be on another shift, creating slack in the schedule that could accommodate occasional inbound delays waiting for the Delaware River tide.
- Since the vessels are reportedly discharging 1400 TEU or more of heavy commodities and taking on very few exports, it is very improbable that the vessels could be loaded anywhere near their 42-foot limit. Even allowing for bunkering in

Philadelphia, it would appear very unlikely that departure draft would ever become a limiting factor.

Thus, the vessels may be able to stop first in Savannah and load near their draft limit with infrequent or inconsequential delay inbound to Philadelphia at existing depths, and no delay outbound to Europe. Given that the vast majority of Delaware River cargo is inbound, the benefits of a two-way channel may not be much greater than the benefits of a notched channel.

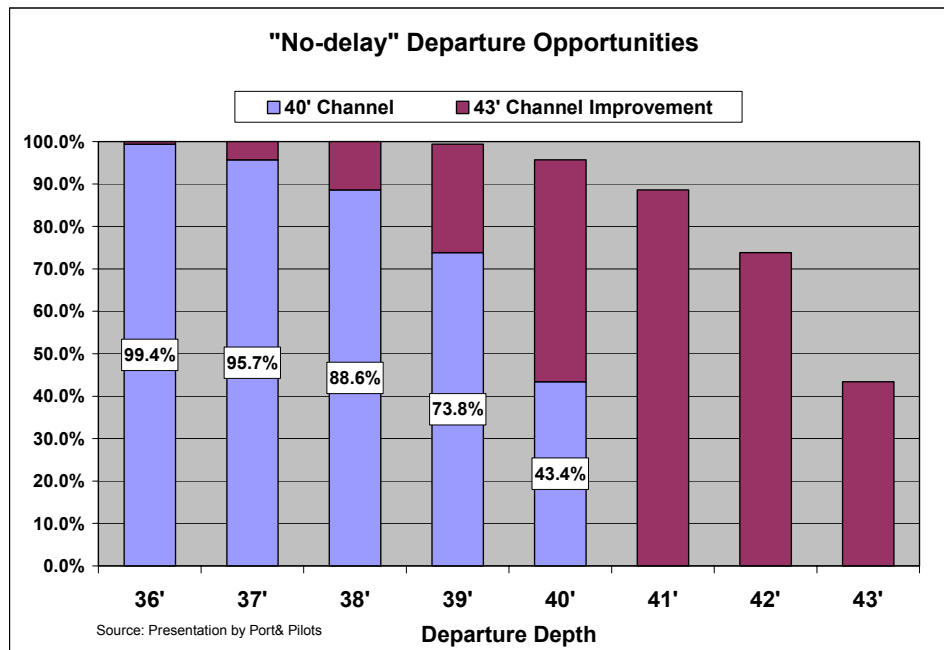
The VSA could also choose to call at Savannah first if vessels are not full. The vessels planned for the 7-day service have a capacity of 4100 TEU, replacing 1200-1360 TEU vessels on a 9-day service. This new deployment will thus increase annual capacity by roughly 300%. It is unlikely that the new vessels will be running full for the first few years, and therefore unlikely that they will be limited by arrival draft at Philadelphia.

Significance of Concern. The estimated container shipping benefits rest entirely on the single vessel rotation scenario considered in the report. Alternatives could result in markedly different benefits.

Specific Actions Needed. The analysis of container vessel draft and port rotation should be augmented to encompass the full range of decision factors, scenarios, and potential impacts. A partial multi-port analysis may be required. The report should present actual data on vessel arrival and departure drafts to support its contentions.

- A history of P&O Nedlloyd/Columbus Lines arrival and departure drafts at Philadelphia and Savannah, focusing on the differences between the ports and between arrival and departure at each (recognizing that, until recently, different vessels were used). In Section 5.5, sailing draft data are mentioned but not provided.
- A history of P&O Nedlloyd/Columbus Lines loadings and unloadings per vessel call in both ports, in TEU, identifying the trades to be served by the new service.
- An analysis of projected draft changes on the P&O Nedlloyd/Columbus vessel itinerary from the Panama Canal (with the 39.5 foot limit) through departure for Europe under without project and with project conditions, including the impact of bunker burn-off.
- An analysis of tidal conditions in the Delaware River for projected arrival drafts, showing the amount and frequency of expected delays and the impact on vessel schedules. An example is provided below, drawn from an analysis by the Columbia River Pilots.

Applicable Corps Guidance. EP 1165-2-1, paragraph 7-1.b. and National Economic Development Procedures Manual, Deep Draft Navigation, IWR Report 91-R-13, page 156.



Corps Response:

We concur with the reviewers' statement that *"It is unlikely that the new vessels will be running full for the first few years, and therefore unlikely that they will be limited by arrival draft at Philadelphia."*

However, it should be noted that the first year that benefits are claimed for this section of the channel is 2009, six years into the service. Analysis of cargo forecasts for the ANZ to the US East Coast, ANZ to Europe, and US East Coast to Europe trades indicate that there is more than enough forecasted tonnage to support this service and that far more tonnage will be loaded at Savannah than will be off loaded, supporting the claim that vessels on this service will depart Savannah at drafts greater than arrival drafts. Also, according to the shipper, a significant amount of refrigerated cargo tonnage on these trades will come from load shifts from smaller, refrigerated cargo vessels to the newer, containerized reefer vessels. This is expected to accelerate the rate at which vessels on this new service will be filled to capacity.

The final version of the report will contain an analysis of forecasted departure drafts from Savannah (arrival drafts at Philadelphia) that will indicate the estimated year in which without-project channel depths at the Delaware River constrain arrival drafts for the planned eastbound P&O/Columbus Line VSA service from Australia/New Zealand.

Analysis of arrival times, as reported by the Pilots Association and confirmed by the PRPA, indicate that arrival time of day is not a constraint on containership operations at Packer Avenue. In the past, vessels have arrived and been offloaded during early morning or night hours. The PRPA expects the occurrence of off-peak, non-daytime arrivals to increase in the future. Discussions with the Pilots Association and the carriers concerning the influence of tide delays confirm that tide delays for containerships arriving at the Delaware River include the time spent waiting for the appropriate tide and the additional time required to transit the channel at slow speeds in order to maintain the tidal advantage through the entire length of the channel to the Packer Avenue Terminal. The total time caused by tide delay may be as much as 10 hours or more and would significantly impact containership schedules. The carriers have indicated that continual occurrences of tide delays could be cause to permanently by-pass Philadelphia as a major port on this rotation.

Panel Conclusion:

The response appears to address the issues, and would resolve them with a few necessary clarifications:

- Significant changes to the affected sections of the Benefits Appendix will be required, and should be subject to appropriate QA/QC measures.
- The Corps should verify the design draft of the new Albatross Class vessels. In some sources it is reported as 12.5 meters, which would be almost exactly 41 feet, not the 42 feet referenced in information presented to date.
- Some press releases from VSA members indicate that the vessels will also call New York. Descriptions of without-project and with-project port rotations should include the New York call unless definitive information is available to the contrary.
- Discussions with the Pilots Association, carriers, et al should be documented.

ACTION TAKEN (NAP 12/06):

Changes to the relevant sections of the benefit appendix have been completed in the final report (see pages 22-25, 51-53, and 66-68 for more details), with the appropriate QA/QC measures also accomplished.

The design draft of the new Albatross Class is 41 feet, and is correctly referenced in the final report.

Descriptions of the without and with project port rotations are fully detailed in the final report, with the requested additional documentation regarding other relevant U.S. ports such as New York and Savannah.

Information obtained from discussions with the carriers and pilots association is also documented in the final report.

Ideally, historic vessel loading patterns would be used to forecast future vessel loading patterns. However, in this case the historic loading patterns are not available because the first vessel (in

the newly built “Albatross-class” fleet) of the regularly scheduled service is just arriving in Philadelphia on 19 December 2002.

However, in addition to the analysis provided in the Benefits Analysis Appendix, the following supplemental discussion provides more insight based upon available information on the loading of a current vessel.

Discussions with operations officials of P&O Nedlloyd on 17 December 2002 identified that the first regularly scheduled vessel of this new service, (the Remuera) was to leave Savannah, Georgia headed for the Delaware River on the evening of the 17 December 2002. The vessel was to be loaded with approximately 2,500 TEU’s and has a sailing draft of approximately 37-feet. This is significant, although only one sample movement, because the first vessel of the new service is already approaching the current sailing draft constraint for containership operations in the Delaware River, a full six years prior to the project base year.

Applying six years of growth to the current TEU load indicates that the vessel load in 2009 would be 3,235 TEU’s. This additional load would cause the vessel to draw an additional two/three feet of sailing draft based on the immersion factor. Using the implicit expectation that the very first vessel call in the new service represents future vessel loads and that the vessel operations such as bunkering and ballasting would be the same as they are today, the vessel would arrive at Philadelphia, Pennsylvania at a sailing draft between 39 and 40 feet in 2009. As a result, the underkeel channel clearance depth requirements for this vessel would be 42 to 43 feet.

The benefiting service has the capacity to carry approximately 8% of the forecasted trade from Australia/New Zealand to Europe and from the South Atlantic region of the U.S. East Coast to Europe. The 2009 load estimate identified above conservatively analyzes that the new service will carry 5% of the potential traffic on this eastbound round-the-world route. Even with this conservative assumption, projected containership sailing drafts support the need for additional channel depth in the Delaware River by the base year.

HEADQUARTERS ASSESSMENT: The action taken **resolves** the basic concerns expressed by the Review Panel in the original comment and the clarifications in the Panel Conclusion.

1.4 BENEFITS OF A TWO-WAY CHANNEL

Statement of Concern. It appears that virtually all of the transportation benefits could be achieved from a one-way or notched channel, at a major reduction in cost. Neither the cost analysis nor the benefits analysis address such an option.

Basis of Concern. The benefits analysis apparently assumes a two-way channel. The vast majority of the Delaware River cargo, however, is inbound, and most vessels will depart either empty (e.g. crude oil tankers) or at lesser drafts than they arrived (e.g. container ships). The report also states that due to the beam of VLCCs, only one-way traffic can be accommodated while they are transiting the channel. There is thus an apparent need to determine the marginal benefits attributable to a two-way channel versus a one-way or “notched” channel.

Significance of Concern. Channel depth optimization is based upon incremental analysis. Support for a 2-way, 45-foot channel, based on a 3-foot underkeel clearance, requires arrival *and departure* drafts of 42 feet to take full advantage of the channel improvements.

Specific Action Needed. The report and the appendices should identify the costs and benefits of a one-way or notched channel, and this the marginal costs and benefits of a two-way channel.

This analysis would require use of the same data on actual arrival and departure drafts that is needed elsewhere.

Applicable Corps Guidance. EP 1165-3-1, paragraphs 5-6.a(3) and 5-7.f. and ER 1105-2-100, paragraph 4-3.b.

Corps Response:

As part of the Corps' Pre-construction Engineering and Design Study, the Corps of Engineers Waterways Experiment Station (WES) with the assistance of the Delaware River Pilots, performed physical model tests to simulate the vessels operations (i.e. meeting and passing) that are commonly experienced in navigating the Delaware River shipping channel for the with and without project conditions. Various channel configurations were tested. The physical model tests revealed that only the two-way channel met the basic test of safe navigability. As a result of this testing, it was concluded that any reduction in channel width would lead to unacceptable compromises in vessel handling, and safety.

Panel Conclusion:

As the concept of a one-way or notched channel is a logical outgrowth of the one-way loaded traffic pattern, the final report should cite and quote the previous reports to put the matter to rest. Assumptions and methodology should be explained.

ACTION TAKEN (NAP 12/06):

The authorized project recommends a full-width deepening of the channel, including the bay portion where the channel is 1,000 feet wide, through the upper bay and river section where the channel is 800 feet wide, up to Philadelphia Harbor where the channel width is 400 to 500 feet wide. As part of the Corps' Pre-construction Engineering and Design (PED) Study, the Corps of Engineers Waterways Experiment Station (WES) with the assistance of the Delaware River Pilots evaluated the operational viability and safety of asymmetric channel deepening for the project.

The WES investigators recommended a physical model-testing program. It was determined that computer-based ship simulations were not appropriate to evaluate the asymmetric channel alternatives. The physical model tests were performed by operating 1:100 scale ship models in a straight 800-foot wide (model scale) sand channel at WES. A three-dimensional video tracking system was used to track two points on each ship and to follow the movements of the rudder relative to the ship's axis. Four configurations of the navigation channel were tested: the existing channel at 40-feet deep; an asymmetric channel 45-feet deep over half of the 800-foot width and 40-feet over the remaining half; an asymmetric channel 45-feet deep over 600-foot of the 800-foot wide channel, with the balance at 40-feet; and a full-width deepened 800-foot wide 45-feet channel. The model ships used in the testing program approximated the size of vessels using the Delaware River shipping channel.

Physical model tests were performed for two basic scenarios. The first scenario represented vessels meeting and passing, in which the vessels are headed in opposite directions and pass port-to-port. The second scenario represented overtaking conditions in which both vessels travel in the same direction, with the smaller ship overtaken by the larger ship. This situation occurs when slower moving tug/barge units or ships are overtaken by large ships moving at higher speeds. Delaware River pilots report that this operation normally is performed in or before entering the 1,000-foot channel in the Delaware Bay, when it is necessary for inbound vessels to be in proper order for arriving at their destinations. However, it may be necessary for a large vessel to overtake another in the 800-foot channel. Based on calendar year 2000 Water Commerce Statistics Center data, the project area recorded a total of 54,622 trips of vessels and barges (27,314 inbound and 27,308 outbound). The average usage per day of the project is 150 movements, and a large number of over takings and meetings occur on a daily basis.

Physical model tests performed in the PED Study concluded that the asymmetric channel was not capable of safely accommodating vessel traffic requirements of the Delaware River navigation system. Further consideration of the economics of the asymmetric channel is not warranted given the conclusion reached by WES and the Pilots that the asymmetric channel alternatives cannot safely meet the needs of the Delaware River navigation system, given its considerable length and dependence on timing of transits to make maximum use of high tides.

This is the fundamental and most important conclusion of the WES memo dated July 15, 1994 on the physical model tests of the asymmetric channel. The concluding paragraph (#25) of the WES memo states “an asymmetric channel will not be acceptable due to the safety of performing overtaking maneuvers. When the traffic is such that overtaking and passing is required anywhere in the navigation channel, then any reduction . . . to less than 800 ft results in unsafe overtaking conditions. This would be particularly true for inbound ships loaded to drafts deeper than 39 ft.” These model tests indicated that asymmetric channel alternatives were unacceptable from the standpoint of navigation safety, especially in the context of the typical, real-world vessel traffic in the Delaware River and Bay. Concepts for asymmetric channel deepening, which may have been applied to other locations with significantly shorter channel lengths, do not represent a safe and efficient alternative for deep draft navigation on the Delaware system.

It was the conclusion of the District and the Delaware River Pilots that the asymmetric channel would be unsafe for inbound deep draft vessels, given their regularly occurring need for overtaking during inbound transits. Thus, the asymmetric channel is inherently unsafe and unacceptable, regardless of the number of other situations (i.e., vessels transiting alone, or two vessels meeting) in which the asymmetric channel could be safely transited. The Delaware Pilots have consistently indicated that meeting and overtaking situations occur regularly during both inbound and outbound trips. Overtaking maneuvers are a critical aspect of efficient use of the Delaware navigation system, as overtaking is often required for deep draft vessels (inbound oil tankers) to maximize their use of high tide for under keel clearance at Marcus Hook range (rocky bottom).

The asymmetric one-way channel would also have a significant adverse impact on navigation economics, even if it did meet engineering safety standards. The major benefiting commodity vessel class, crude oil tankers (representing 60% of the total benefits) would be most adversely affected. These large tankers are faced with the common navigational occurrence of overtaking and passing slower inbound vessels to maximize tidal use. An asymmetric channel would render this standard navigational practice unsafe, if not completely eliminate this capability for these large tankers. Also, other benefiting vessels (such as large time-sensitive container ships) are

expected to require the full two-way channel for the services of the rapidly expanding round-the-world-service trade route.

HEADQUARTERS ASSESSMENT: The physical model tests were performed by operating 1:100 scale ship models in a straight 800-foot wide (model scale) sand channel at WES. The average usage per day of the project is 150 movements, and a large number of over takings and meetings occur on a daily basis. When the traffic is such that overtaking and passing is required anywhere in the navigation channel, then any reduction to less than 800 ft results in unsafe overtaking conditions. The action taken describes the WES model and the conclusion of the District and Delaware River Pilots that safety traffic density and tidal timing make the asymmetric channel inefficient for accommodating traffic in the 100-mile long channel. Furthermore, reconsideration of channel width was not within the scope of the Comprehensive Economic Reanalysis Report. Therefore information regarding this matter was not included in the report, and the Action taken **resolves** the concern.

2.0 CARGO PROJECTIONS

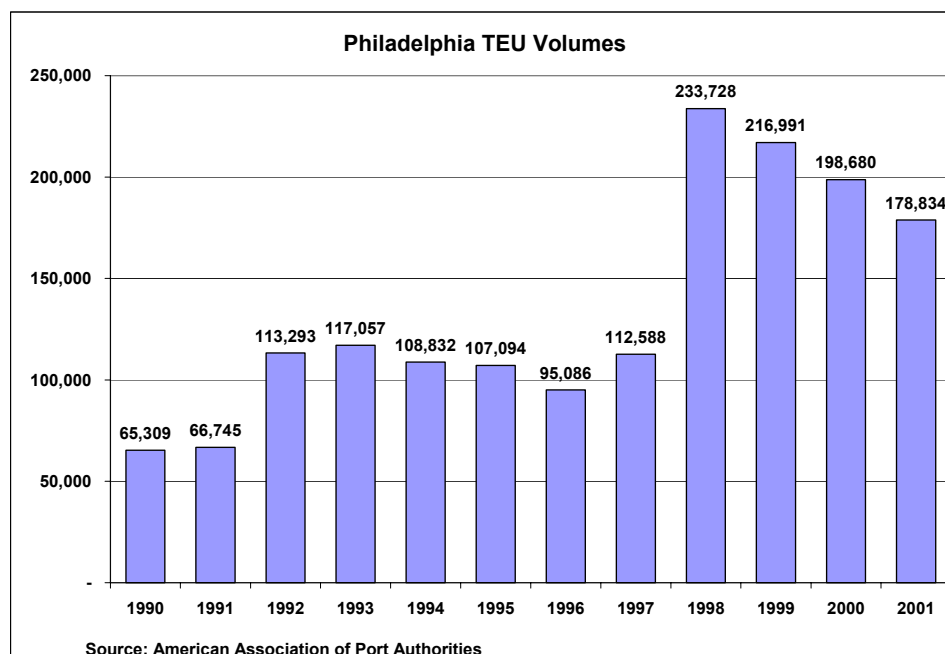
2.1 LACK OF HISTORICAL CARGO DATA OR ANALYSIS

Statement of Concern. There is no historical information on cargo flows through the Delaware River Ports to put the forecasts in context or justify confidence in the projections. Documentation is insufficient.

Basis of Concern. Traffic volumes at ports with only a few commodities, carriers, and customers are inherently volatile. In the absence of historical data and analysis of past trends, it is impossible to judge the reasonableness of cargo forecasts or conduct a meaningful sensitivity analysis. With only a very few commodities at issue, market or logistics changes in global sourcing or supply could have serious consequences for the anticipated benefits.

Container Cargo

AAPA data indicate that Philadelphia's TEU count doubled between 1997 and 1998, and has declined markedly since, as shown below. Absent a thorough analysis of this trend, the reliability of a forecast for steady future growth is questionable.



Furnace Slag

The identification of 1,000,000 annual tons of furnace slag as a new and reliable commodity flow is dubious without verification. The description of the slag contract and facility investment is apparently based on a single interview with SJPC, not the cement companies involved, and is not by itself a reliable basis to make a cargo forecast. The whole scenario rests on the commercial success of a single producer who will not share his plans. Without context (e.g. information from his customers, demand for the product in the area, etc.), this is an inadequate basis for benefits analysis. Other ports have idle terminals as result of major customers walking out of contracts when circumstances changed.

Steel Slabs

The growth rates for steel slab imports, appear reasonable, but there are no data presented on past flows of steel slabs to provide perspective or confidence. Some discussion of the market, industry, and firms would help substitute for lack of data related to this commodity.

Crude Petroleum.

In section 3.4.1 (Table C-4), the history of refinery crude receipts indicates a 4.9% decline in 2001. In the absence of historical perspective on the pattern of import over time, the meager data presented suggest a downward trend. Faced with this fact, the sensitivity analysis should have either found the reasons for the decline or included a declining case in the sensitivity analysis.

1999 bbl/Day	2000 bbl/day	2001 bbl/day
1,082,677	1,084,605	1,031,610

Significance of Concern. The magnitude of most benefits is directly tied to the cargo projections, in conjunction with fleet projections. (Although the Container Model does not use the DRI-WEFA projections.)

Specific Actions Needed. The report needs data on previous cargo flows at Delaware River ports and a discussion of the factors that have influenced cargo volumes. For commodities currently or previously subject to quotas, the cargo forecasts should consider the range of potential impacts. A partial multi-port analysis will be required to address existing and potential competition from other ports and the subsequent impact on cargo projections.

Cargo histories should be presented in terms directly comparable to the cargo forecasts incorporated in the benefits models (e.g. for the same commodities and trades in the same units).

The forecast for furnace slag requires verification through analysis of cargo history or the market for the product, including port pairs. Second-hand estimates provided by the Port or the terminal operators are not a reliable basis for a forecast.

Applicable Corps Guidance. National Economic Development Procedures Manual, Deep Draft Navigation, IWR Report 91-R-13, page 138.

Corps Response:

The final report will be revised to present additional information on the specific benefiting commodities. The additional information to be added is summarized below, by commodity type.

*COMPARISON OF HISTORIC TONNAGE TO FUTURE COMMODITY PROJECTIONS FOR
BENEFITING COMMODITIES*

A. INTRODUCTION

Historic PIERS tonnage data from the Delaware River Port Authority (DRPA) for Pennsylvania and New Jersey for 1) crude oil imports (excludes Motiva), 2) containers (excludes Port of Wilmington), and 3) steel slab imports, for the 12-year historic period from 1990-2001 has been assessed in this analysis. DRPA was not able to provide information specific to another benefiting commodity, refined petroleum products for Delaware Terminals, located in the state of Delaware; however, the historic pattern for this commodity should approximate crude oil imports. An additional benefiting commodity, imported slag to Beckett Street Terminal, just commenced moving through the port in 2001, so no long-term historic set of data is available. Also, the crude oil data provided by DRPA for this entire period has consistently applied the old PIERS conversion factor. Please note that the year 2000 crude oil import data used in the Corps benefit analysis as the baseline has properly adjusted the PIERS conversion factor. Graphs of historic tonnage and future projections to year 2020 are displayed in Section B. below.

Future growth rates applied in the benefit analysis are as follows by commodity (presented for the first 10 year study period and the complete 60-year period of consideration):

CRUDE OIL

2000-2010: 0.27%/year

2000-2060: 0.21%/year

CONTAINERS

2000-2010: 4.39%/year

2000-2060: 3.4%/year

STEEL SLABS

2000-2010: 2.18%/year

2000-2060: 1.0%/year

REFINED PETROLEUM PRODUCTS

2000-2010: 0.37%/year

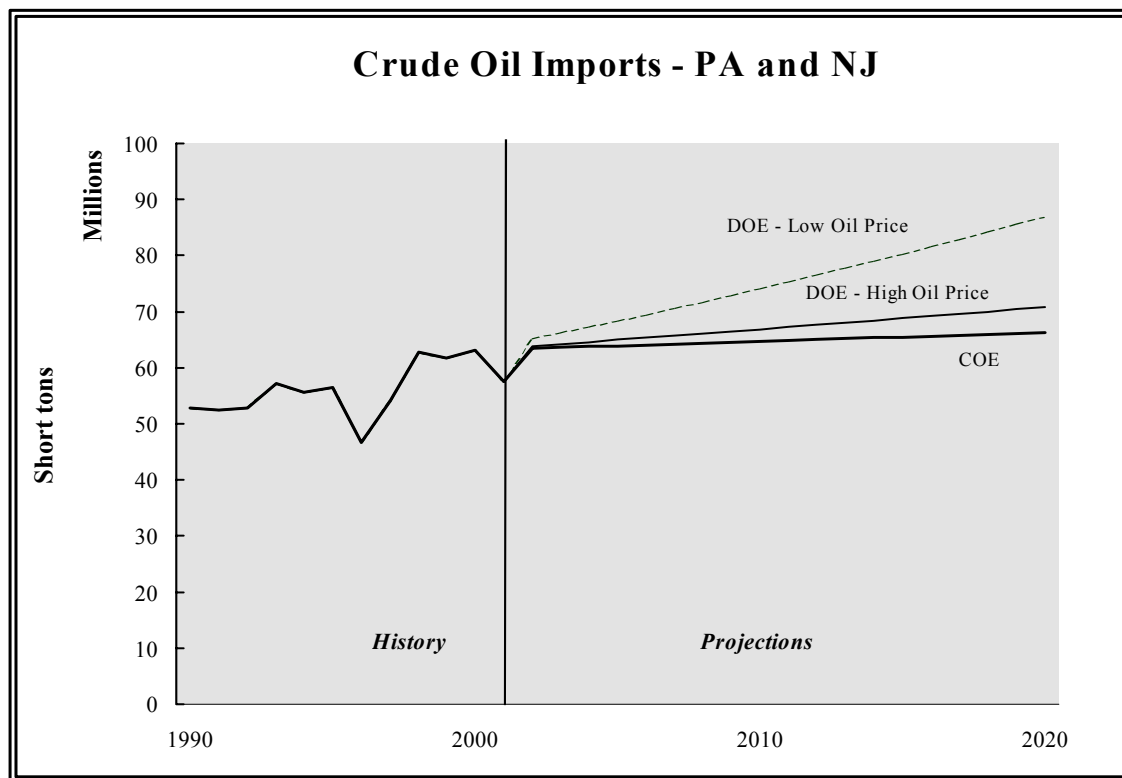
2000-2060: 0.40%/year

B. COMPARISON OF HISTORIC AND FUTURE TONNAGE GROWTH**CRUDE OIL**

Crude oil imports have displayed slow, upward growth over the historic period of 1990-2001. 1996 showed a significant downward “blip” as Tosco purchased the British Petroleum refinery and shut down operations for that year to complete a modernization program. Average annual growth for 1990 to the study year of 2000 in the benefit analysis is equal to 1.8%. 2001 has displayed lower tonnage than 2000, but the average annual growth from 1990-2001 of 0.8% is still well in excess of the future growth applied in the crude oil benefit analysis of 0.21% per year.

2001 tonnage was lower than 2000 tonnage for the following reasons: 1) for the last part of calendar year 2001, U.S. oil demand declined as a direct result of the aftermath of the 9/11 terrorist attacks (particularly for gasoline), 2) a relatively warm winter contributed to lowered demand for heating oil, and 3) recessionary pressures within the U.S. economy contributed to reduced demand for crude oil imports.

The Department of Energy (DOE) Energy Information Administration’s Annual Energy Outlook 2002 presents projections of U.S. crude oil imports for the period 2000-2020. The range of total growth for five scenarios over the 20-year period ranged from 12.2% (High Oil Price Scenario) to 37.8% (Low Oil Price Scenario). The Delaware River benefit analysis, by comparison, projects total crude oil import compounded growth through the port of only 5.0% over this period.



CONTAINERS

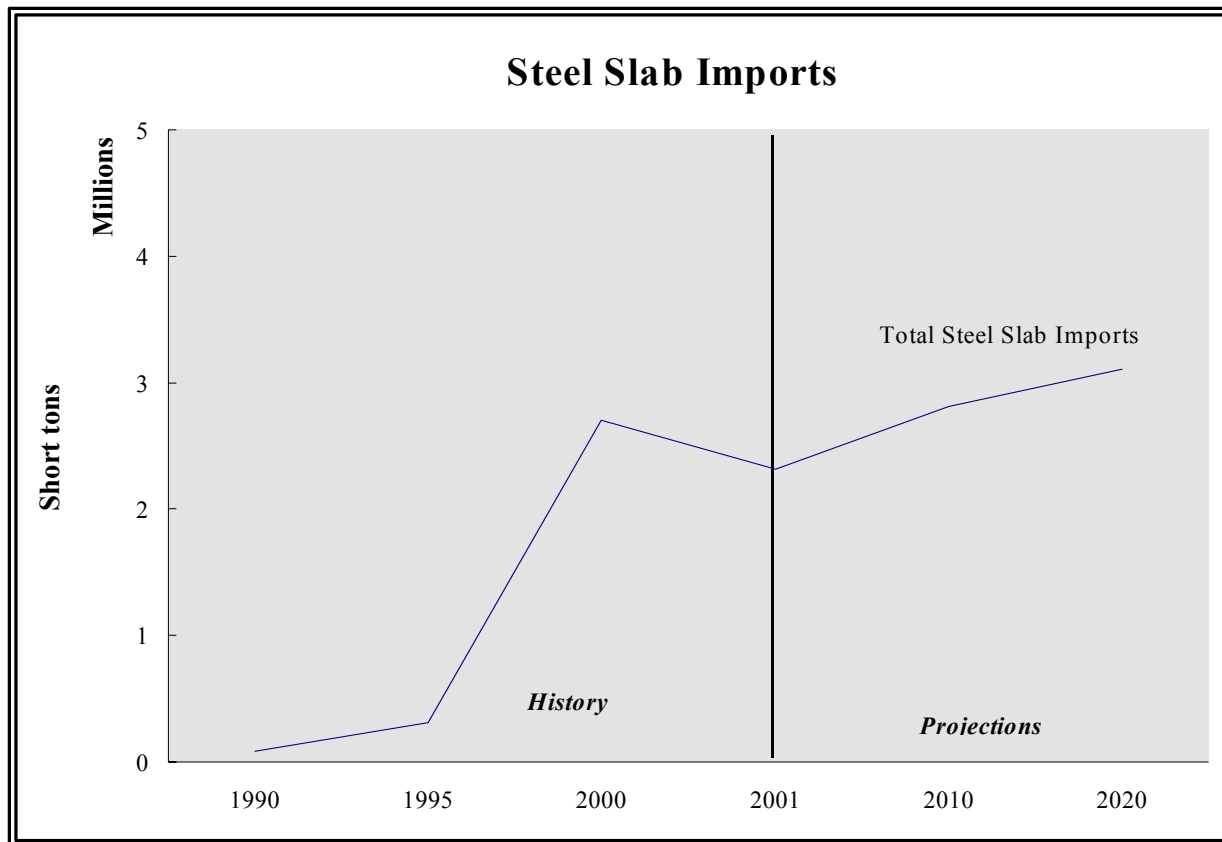
Total container tonnage and Australia/New Zealand trade route tonnage display average annual historic growth for the period from 1990-2001 of 1.3% and 2.2% per year, respectively. The last five years (from 1996-2001) specifically for the benefiting trade route of Australia/New Zealand shows an average annual growth rate of 6.5%. Future average annual growth of 3.4% applied in the benefit analysis for this trade route compares well with the historic data.

STEEL SLABS

Steel slabs have shown very significant growth, with the 2001 total exceeding the 1990 total by a factor of twenty-seven. The last five years from 1996-2001 has displayed average annual growth of 13.2%, well in excess of the average annual future growth of 2.18% applied in the benefit analysis for the next ten-year period to 2010, or the 1% average annual growth applied over the period extending to 2060.

The following information was obtained from the DRI-WEFA steel group economist:

Steel slabs, even from Brazil, will likely not be tariffed as high as finished steel products going forward. This will help the growth in slab imports to continue at a more rapid pace than overall iron and steel imports into the U.S. The key is the links between foreign basic slab producers to U.S. domestic rolling mills. The U.S. will not protect the domestic raw steel production from competition from imported slabs as much as it will protect by tariff the U.S. finished steel products from domestic steel producers, which is the higher value-added production. With links with the finished steel product producers within the U.S., the basic steel slab producers will have the political support domestically to continue to expand their share of the U.S. market.



BLAST FURNACE SLAG

No historical trends are available to compare to the projections contained in the analysis, because blast furnace slag is a new commodity movement in the Delaware River port that began in 2001 with the opening of the St. Lawrence Cement GranCem® facility in Camden, New Jersey. For this reason, information on the U.S. market for GBFS has been obtained to provide additional support for the projections used in the analysis.

St. Lawrence Cement operates four cement plants and numerous other facilities to serve 15,000 customers in Canada and on the Eastern Seaboard of the United States. The company's Canadian operations include a cement plant in Joliette, Quebec and 13 cement distribution terminals, one mineral components distribution terminal, 46 ready-mix concrete plants, 22 quarries and sand pits and two construction companies. These assets are located in Ontario, Quebec, and the Maritimes.

In the United States, the company operates two cement plants, one in Catskill, NY, and another in Hagerstown, MD. Its U.S. operations also include nine cement distribution terminals and sources and markets fly ash and ground slag, both mineral components. In mid-1999, upgrades to the two Canadian plants increased production capacity by 180,000 metric tonnes. Plans are underway for the construction of a two million metric tonnes cement plant in Greenport, N.Y. St. Lawrence also owns and operated two new facilities in Sault Ste. Marie, Ontario, and Camden, New Jersey. These new facilities produce a performance enhancing cementitious material (granulated blast furnace slag) from a by-product of iron and steel manufacturing.

The Slag Cement Association is a trade association whose membership is comprised of the major U.S. GBFS processors. Members include: St. Lawrence Cement, Essroc Cement Corp., Holcim (U.S.) Ltd., Lafarge North America, Lehigh Cement Company, Lone Star Industries, and St. Mary's Cement Inc. (U.S.). Included below is a press release from the Slag Cement Association describing recent trends in the GBFS market:

"New Record Set for Slag Cement Shipments in 2001

Concrete specifiers and producers continued to use record amounts of slag cement in their concrete in 2001, the fifth consecutive year. Slag cement is a hydraulic cement which replaces a portion of the portland cement in a concrete mixture. It is shipped both as a separate finely-ground hydraulic cement and as a blended cement combined with portland cement. Both forms exceeded the previous year's record levels. Use of slag cement shipped as a separate product increased by 17% in 2001, for a total of 2.26 million metric tons. Use of blast-furnace slag blended cement increased by 43%, for a total of 560 thousand metric tons. Annual growth of slag cement and blended cement has averaged 16% and 50%, respectively, from 1996 – 2001."

Also provided below are excerpts below from St Lawrence Cement's 2nd Quarter 2002 Earnings Announcement:

"The Company's cement plants are operating at high capacity levels and we are also benefiting from additional volume from the recently acquired aggregate quarry in Acton, Ontario, the new crushing facility at the Varennes quarry near Montreal and higher production rates at our GranCem® facility in Camden, New Jersey.

Camden GranCem(R) Facility Update

We are pleased to report that the Camden GranCem® facility is producing at target levels and achieving strong customer acceptance. GranCem® is used to enhance cement mixes in specific applications..."

Additional information of the U.S. Market for GBFS was obtained from the U.S. Geological Survey. The USGS Mineral Resources Program provides and communicates current, impartial information on the occurrence, quality, quantity, and availability of mineral resources. Discussions with the USGS Commodity Specialist for iron and steel scrap (the category in which blast furnace slag falls) yielded the following information.

U.S. imports of blast furnace slag are now ranging between 1.2 and 2 million metric tons. Import tonnage is expected to increase by another 1+ million metric tons in the next several years, primarily because of increasing demand for processed GBFS and decreasing U.S. steel production that is resulting in less slag byproducts.

Source supply of raw materials and GBFS processing capacity, rather than final product demand, is the current constraint on U.S. GBFS production volumes. In general, U.S. GBFS processing facilities are able to sell everything they can produce, due to extremely high demand for their product and the size of the U.S. Portland cement market relative to GBFS processing capacity.

Additional market data for blast furnace slag was obtained from the USGS Mineral Commodities Summary 2002 and Minerals Yearbook 2001. The complete documents are included in Attachment 1 (embedded Adobe Acrobat files). An excerpt is shown below.

“In 2001, the United States imported 2.6 Mt of ferrous slags. Granulated BF slag (GGBFS), which commands the highest price among ferrous slags, led the imports. In 2001, 1.8 Mt of GGBFS was imported. Imports of GGBFS, in descending order, were mainly from Canada, Italy, Brazil, Japan, and France. Principal discharge ports were Tampa, FL, New Orleans, LA, Philadelphia, PA, and Detroit, MI. In 2001, imports accounted for 15% of total ferrous slag shipments in the United States. This significant increase in imports was the result of a decline in the U.S. iron and steel production in 2001.”

Panel Conclusion:

The responses correctly address most of the panel’s concerns. These responses need to be incorporated into the final benefits appendix and subjected to sensitivity analysis (as noted elsewhere). The Panel had the following additional observations:

- The analysis apparently did not consult the Waterborne Commerce of the United States (compiled by IWR). That source should be reviewed for data on flows not covered by PIERS.
- The assumption that the history and pattern of refined petroleum products should approximate that for crude oil is questionable and must be verified. One plausible scenario is that imports of refined products will grow faster once regional crude refinery capacity has been reached and production growth slows.
- Container data cited in the text of the response do not seem to match the graph. The graph appears to show very gradual growth in 1995-2000 and a more aggressive forecast. Also, some explanation should be given for the emphasis put on growth over the last five years.
- Where commodity histories show significant variability, the reasons for variability and the outlook for future variability should be discussed.

ACTION TAKEN (NAP 12/06):

WCSC data was reviewed as a source during the study analysis. Crude oil imports, reported by both DRPA and WCSC, applied piers data as the input source for each. For other benefiting commodities (bulk and container), facility or shipper-specific data obtained from primary sources and DRPA was more detailed than data available from WCSC. WSCS data, though, was checked as a source to verify reasonability.

Projected growth in refined petroleum products is very modest at 0.4%/year (for this minor benefiting category comprising only 1.4% of the total). The even more modest 0.21%/year

growth rate for crude oil imports to refineries means that a refinery capacity constraint is not a relevant issue to the analysis.

The 1996-2001 historic annual growth rate of 6.5% for the Australia/New Zealand container trade route significantly exceeds the 3.4%/year growth projected by DRI-WEFA. The twelve years of historic data on the graph muted the impact of the impressive growth for the last five years of data. The recent data is important because of the evolving round the world service, which includes this trade route as one segment.

The historic and potential future variability of commodities has been fully considered in the development of commodity projections.

The above information has been incorporated into the final report benefit appendix write-up. Reference pages 39-46 and 53-68.

HEADQUARTERS ASSESSMENT: The action taken **resolves** the concern expressed by the Review Panel in the original comment and in the Panel Conclusion. The response information was incorporated into the report text. The observations in the review panel conclusions were specifically addressed in the final report and in addition the QA/QC.

2.2 LACK OF FORECAST DOCUMENTATION OR CONSISTENCY

Statement of Concern. The cargo forecasts produced by DRI-WEFA lack documentation of crucial steps. The Corps models do not all use the DRI-WEFA forecasts, and the deviations are undocumented. The overall treatment of cargo projections cannot be verified and lacks credibility.

Basis of Concern. The treatment of Delaware River cargo shares is critical for the cargo forecast. The forecast documentation, however, does not explain how the worldwide bilateral trade forecast was made specific to the Delaware River Ports. The DRI-WEFA source does not ordinarily forecast at this level of detail: the East Coast is normally split between the North Atlantic Coast (which would include the Delaware River Ports) and the South Atlantic Coast. Furthermore, DRI-WEFA forecasts ordinarily assume fixed port cargo shares and do not consider the relative performance of competing ports. The methodology discussion on pages C-40-41 does not go down to the Delaware River Ports level.

The Corps container benefits calculations do not employ the DRI-WEFA forecast, but replace it with undocumented 2003 TEU estimates and undocumented USACE/DMA growth factors. The container commodity flow projections in Table C-18 are not backed by any documentation. The TEU per vessel figures used in the Container Cost Model have no explanation or audit trail. The analysis apparently derived terminal-specific cargo growth rates (below) but the description of the method is vague and inadequate. As shown below for container traffic, for example, the rates are slightly higher than DRI-WEFA's rates. In Section 4 of the reanalysis, the text states that projections for other commodities were "developed separately" but does not explain how or give the data used. In the absence of documentation this procedure undercuts confidence in the report.

	2000	2010	2020	2030	2040	2050
DRI-WEFA (Figure C-8)						
Forecast (MM Tons)	2.56	3.88	6.05	7.76	8.81	9.15
Growth Rate		4.25%	4.54%	2.52%	1.28%	0.38%
Corps (Table C – 17)						
Growth Rate		4.39%	4.57%	2.54%	1.33%	0.45%

Many of the tables in Section 4.1 are of no relevance to the analysis, and the tables the panel would expect to see are not given. In particular, Table C-15a is not given in TEU nor are the commodity descriptions related to the volumes and cargoes used in the Container Model.

Significance of Concern. The cargo projections are purportedly the basis for all estimates of project benefits.

Specific Actions Needed.

- The DRI-WEFA forecast needs explicit documentation regarding the allocation of North Atlantic cargo to the Delaware River Ports.
- The deviation between DRI-WEFA growth rates and the growth rates eventually used by USACE/DMA requires complete documentation and justification.
- A clear audit trail should be apparent linking the various forecasting data sources and steps
- These allocation steps require sensitivity analysis.

Applicable Corps Guidance. EP 1165-2-1, paragraph 7-1.b.

Corps Response:

DRI-WEFA will provide the documentation regarding the allocation of North Atlantic cargo to the Delaware River ports. Omission of this documentation was an oversight and it will be included in the final report. The deviation between the DRI-WEFA growth rates presented in figure C-8 and the growth rates used in the transportation cost calculations, presented in table C-17, occurred because the growth rates presented in Table C-17 were derived from the most current version of the forecast model. The growth rates presented in Figure C-8 are from an earlier version of the model that was not used in the transportation cost calculations. DRI-WEFA forecasts were not used for future slag imports because the DRI-WEFA model did not identify slag as a specific import commodity. Because of the importance of slag as a singular commodity being imported into the Delaware River, and because slag is only a minor component of the forecasted commodity bundle that contains slag, a specific slag forecast was developed from local user industry information. A more thorough presentation of rationale for the slag forecast will be presented in the final report.

Panel Conclusion:

The response appears to address most of the panel's concerns.

- The final report should reflect the changes, and it should be possible for a reader to follow the completed analysis from historical data through forecasts, adjustments, and benefits estimates.
- Sensitivity analysis should be performed to determine the impact of assumptions and approximations made in the analysis.

ACTION TAKEN (NAP 12/06):

As requested, the final report benefit appendix reflects both the above changes and a full range of sensitivity analyses for the container benefit category (reference pages 39-46, 51-53 and 82-95).

HEADQUARTERS ASSESSMENT: The action taken **resolves** the concerns expressed by the Review Panel.

3.0 FLEET CHARACTERISTICS

3.1 EXISTING CONTAINER SERVICES AND FLEET CHARACTERISTICS

Statement of Concern. The descriptions of existing P&O, Columbus Lines, and Aliança operations and vessels in the August report were incorrect; the September report appears to have resolved this problem.

Corps Response:

Comment noted – issue is resolved.

Panel Conclusion:

Issue resolved.

3.2 FUTURE CONTAINER SERVICES AND FLEET CHARACTERISTICS

Statement of Concern. The August report mischaracterized the planned RTW service of P&O Nedlloyd and Columbus Lines. The September report corrected the problem.

Corps Response:

Comment noted – issue is resolved.

Panel Conclusion:

Issue resolved.

3.3 FUTURE BULK FLEET CHARACTERISTICS

Statement of Concern. The choice of future vessel to represent the steel slab and furnace slag fleets is questionable, and should have been addressed in the sensitivity analysis.

Basis of Concern. According to Section 3.7.2 of Appendix C, the Maria Salamon was used to represent the slag fleet. By choosing a 46-foot draft vessel, the analysis effectively assumes that all future vessels could benefit from channel deepening. This should entail a sensitivity analysis. The discussion of slab vessels is confusing. Is it suggesting that the Packer Avenue terminal operator chooses the vessels? This seems unlikely. There are no data to back up the discussion of sailing drafts, nor is there any explanation of why some vessels are loading to less than 37 feet (e.g. the range of 35 to 40 feet) at present. The analysis chose two vessels of 42 and 47 feet, thereby guaranteeing benefits, yet there are some vessels in the current fleet that cannot take advantage of the current draft (e.g. have design drafts of less than 37 feet).

The information presented in Appendix C Table C-13 shows the potential advantages of larger vessels, but does not demonstrate that larger vessel will indeed be used.

Significance of Concern. Project benefits depend on vessel draft. In the absence of a complete analysis, the benefits lack support.

Specific Action Needed. The report needs to address the full range of vessels engaged in both trades and their actual arrival and departure drafts. The sensitivity analysis needs to address the potential range of vessel s that could be used in the future and the sensitivity of the benefits analysis to vessel assumptions.

Applicable Corps Guidance. EP 1165-3-1, paragraph 5-7.e.

Corps Response:

Provided below are additional discussions on the selection of the blast furnace slag and steel slab fleets. This information will be added to the final report.

Furnace Slag Fleet

Data on vessel characteristics, sailing drafts, and import tonnage for the existing slag fleet are shown below (table extracted from Bulkiers Database sheet in Bulkiers file). As can be seen from this table, all vessels currently transporting furnace slag have design drafts sufficient to take full advantage of the existing channel depth, and have arrived at (or near) the maximum sailing draft allowed by the channel. Based on sailing drafts at their destination in the Delaware Bay, it is likely that these vessels actually departed their port of origin full, or nearly full, accounting for fuel burnoff.

For future without project conditions, the existing fleet was used, since it appears to be optimally sized based on existing channel depth. However, to accommodate anticipated future growth in tonnage, additional vessels will need to be added to the service. Therefore, a synthetic representative vessel was created based on the arithmetic average of the deadweight tonnage of the existing fleet (excluding the Maria Salamon, which appears to be an outlier). Vessel operating costs for this synthetic 65,347 DWT vessel were calculated using the vessel cost constants and slopes that were calculated from the IWR VOC tables and shown on the input sheet of the Bulker model. These vessels were then allowed to fill to 40 feet in the without project condition and were added to the fleet as needed in any given year to accommodate the total tonnage forecast growth.

Vessel Name	Arrive Date	Origin	Dwt tonnes	DesDraft	Sail Draft	Tons2001
CIC SPLENDOUR	02/21/01	TARANTO	64,919	42	40	61,130
CIC SPLENDOUR	09/01/01	TARANTO	64,919	42	40	61,130
HEBEI DIAMOND	07/26/01	TARANTO	66,767	43	40	60,983
KONKAR THEODORA	12/06/01	TARANTO	65,282	42	40	61,480
MARIA SALAMON	11/01/01	KIMITSU	74,117	46	39	59,713
MICHELE IULIANO	04/10/01	ITALY	64,850	41	40	62,957

For with project conditions, a fleet shift to vessels that were large enough to take advantage of the deepened channel was assumed. We believe the selection of larger vessels for the with project fleet is appropriate for the following reasons:

- The without project fleet currently calling on the port has been sized recognizing existing channel constraints. All vessels have design drafts in excess of the existing channel depth (40') and all vessels, except one, have arrived at full channel depth (the lone exception arrived at 39'). Departure drafts are not available for these vessels, but are irrelevant to the analysis, since all inbound slag is off-loaded at Packer Avenue, and the vessels depart empty and therefore unconstrained under both without and with project conditions.

- Use of the same vessels under with project conditions would result in little or no benefit for a deeper channel, since these vessels are arriving nearly fully loaded now. However, this is not a plausible scenario. First, the shipper indicated that they would shift to larger vessels to reduce transportation costs. Second, the analysis shown on Table C-13 in the report demonstrates that this shift would be economically rational. Third, larger bulk vessels are readily available on the charter market and there are no barriers to vessel replacement. Fourth, at a slag cost of \$8.60/ton (see USGS report), the \$1.36/ton transportation cost differential shown in the Table below provides a significant incentive for a shift to larger vessels (and a significant competitive advantage for imported slag from Italy). For all these reasons, we believe the proposed future fleet shift under with project conditions is supported.

Table C-13
With and Without Project Bulker Fleet
Average Transportation Cost Per Ton (2009)

40 Ft. Channel And Without-Project Fleet		
	Slag	Slabs
Total Costs	\$10,436,929	\$11,287,884
Total Tonnage	1,000,000	1,007,880
Avg. Cost/Ton	\$10.44	\$11.20
45 Ft. Channel And With-Project Fleet		
Total Costs	\$9,079,233	\$8,537,075
Total Tonnage	1,000,000	1,007,880
Avg. Cost/Ton	\$9.08	\$8.47

The selection of the design vessel for the with project condition fleet has been questioned by both the EITR reviewers and HQUSACE and will be changed in the final analysis. The Maria Salamon was originally chosen because it was an actual slag vessel that had called on the port. However, the selection of this vessel was questioned based on its age and configuration. Therefore, a representative with project condition vessel with a design draft of 47 feet and appropriate DWT will be selected from the 2002 IWR VOCs. These vessels will be allowed to fill to full channel depth (45 feet) under with project conditions.

Steel Slab Fleet

The presentation of vessels arriving at cargo loads greater than their dead weight tonnage and vessels arriving at sailing drafts greater than published design drafts has been reevaluated and is confirmed to be based upon actual observations. No changes will be made to the existing data. Any discrepancies between the description of the future slab fleet in the text and the future slab fleet used in the model will be corrected in the final report. Also, any unnecessary worksheets or pages in the spreadsheets will be eliminated from the model to avoid confusion.

Additional vessels used in future tonnage growth for the without project future fleet will be modified based upon reviewer recommendations. The modified additional vessels will contain appropriate dead weight tonnage and design draft characteristics as observed in the existing data. The Corps' vessel operating cost data will be used as guidance for selecting the appropriate vessel capacity and cost.

Panel Conclusion:

A large part of the confusion regarding vessels used in various stages of the analysis arose because of disparities between 1) report text, 2) spreadsheet documentation, 3) spreadsheet practice, and 4) suggested responses to issues raised in the previous QA/QC report. These disparities are apparently the result of attempting successive revisions under tight time pressure, but must be corrected in the course of final report preparation.

The final version of the bulker model should be subjected to rigorous quality control steps to verify that:

- All proposed responses to this comment and previous HQUSACE comments on the same subject are implemented in the final model.
- Vessels chosen for future fleets for both steel slabs and furnace slag are representative of logical, efficient fleet choices under both with and without project conditions.

The final report should also confirm that the foreign origin ports for the steel and slag traffic have sufficient depth to load the vessels to 43 feet.

ACTION TAKEN (NAP 12/06):

The final report bulker model has fulfilled the above requirements of rigorous quality control and incorporating both external review panel and HQUSACE comments to assure the selection of the most logical, efficient vessel fleet. The final report has also confirmed the sufficiency of the depth of the foreign origin ports. Reference pages 49 through 51 of the final report appendix for details.

HEADQUARTERS ASSESSMENT: The action taken **resolves** the concerns expressed by the Review Panel.

4.0 LIGHTERING

4.1 INAPPROPRIATE USE OF LIGHTERING PRICES VS. COSTS

Statement of Concern. The analysis of lightering “costs” and the benefits from reduced lightering actually use an estimate of “representative” lightering *price*, which is inappropriate in the context of project decision-making.

Basis of Concern. Among the non-structural alternatives to channel deepening is the practice of lightering, now used extensively in the Delaware Bay for crude petroleum imports. The COE report concludes that the proposed project will reduce, but not eliminate the need for lightering petroleum. This reduction is the source of average annual benefits of \$16.1 million, or 62 percent of project benefits. Since claimed benefits exceed costs by only \$3.5 million, an overstatement of lightering benefits as small as 20 percent would be sufficient to negate most of the projected net benefits.

Presently, petroleum lightering services for at least four of the seven large refineries in the Delaware Bay are provided by a single carrier, Maritrans. The other refineries use their own

vessels to provide all or a portion of needed lightering, or avoid lightering altogether. The COE report values all the project-related reduction in lightering in terms of Maritrans prices (\$ per bbl), with some further adjustments for changes in time requirements. There is no doubt that the assumed cost of lightering services is a highly significant parameter. The COE report states: “the cost to lighter is a critical input variable in the analysis.” But rather than examine actual costs, the report bases the benefit estimate entirely on an estimated charge by Maritrans of \$0.35/bbl, based on information obtained in an interview. This approach raises a number of concerns.

- Maritrans’ presumed price is not a suitable proxy for avoided cost. EP 1165-1 calls for use of current transportation costs in NED evaluation noting that prices/rates are volatile and there may be evidence that they are unrelated to long term costs. Avoided social opportunity costs are the correct measure of NED benefits in this case. Prices/rates can only be used as a surrogate for avoided costs under limited circumstances, none of which appear to apply here. Under conditions of strong competition, prices are typically forced down to near marginal or average costs, and might be taken as a surrogate for costs. Maritrans, however, has no immediate competition. Indeed, the previous version of the report stated that Maritrans has previously raised prices to recover revenue from lost business, and as noted below there are other indications of Maritrans’ pricing power.
- Even if Maritrans is obliged to price its services at a competitive level (the report makes a case for this, even in the absence of an alternate provider), the presence of substantial fixed costs will insure that reliance on a fixed price/rate leads to an overestimate of benefits.
- Maritrans’ lightering prices/rates are not known with any degree of specificity, as explained in detail below. Even if the lightering price was a suitable proxy for costs, reliance on a single, unsupported number based on an interview with an interested party is unacceptable.
- Reliance on Maritrans prices, rather than costs, ignores the possibility that Maritrans itself may be the recipient of project benefits, or may experience adverse without-project effects that offset apparent benefits accruing to refineries or shippers.

Significance of Concern. As noted above, 62 percent of the project benefits depend on this single variable.

Specific Actions Needed. The Corps should perform a careful analysis of lightering costs. The analysis should be at a level of detail at least comparable to vessel cost analyses employed elsewhere in this report, or used for lightering costs in other port studies (Corpus Christi, for example). In the absence of such an analysis, the benefit estimates used in this report cannot be considered reliable or reasonable.

The Corps has begun what appears to be an appropriate analysis, and preliminary modeling spreadsheets were made available to the review panel. However, the analysis was substantially incomplete at the time of review and only partially documented. Accordingly, the panel could reach no conclusion on the adequacy of the analysis.

Applicable Corps Guidance. ER 1105-2-100, paragraphs E-10.d.(4)(b),(5), and (6).

Corps Response:

The Corps will perform an analysis of lightering costs as the basis for this benefit category. To meet the review team concern expressed in Comment 4.1, the analysis will be at a level of detail at least comparable to vessel cost analyses applied elsewhere in the report.

Vessel operating costs for both at-sea and at-port categories for the existing Delaware Bay lightering fleet are being developed with help from IWR, applying the spreadsheet format presented at the 4 November 2002 meeting. Preliminary values were included in responses to comments on 17 October 2002. Data used by IWR has been obtained from a number of maritime sources, including tug and barge companies, marine brokers, and the annually published generalized VOC's for similar vessels. A weighted average of at-sea/at-port cost costs per barrel will be developed separately for the without and with project conditions. A single weighted cost per barrel will be entered into the existing tanker model to compute lightering costs for each project condition.

The without project condition cost will apply the existing lightering fleet as input for determining the weighted average cost per barrel. The with project condition weighted average cost per barrel analysis will need to determine whether the reduction in lightering volumes is sufficient to eliminate the need for the least efficient of the existing lightering vessels, or to cause a replacement of one of the existing vessels with a smaller vessel.

The crude oil lightering benefit category in the September 02 report was based on price, not cost, so the revised report will have a revised benefit analysis using the cost parameter recommended by the External Independent Review team.

Panel Conclusion:

The approach to a lightering cost analysis described above would – if successfully implemented, subjected to QA/QC steps, and documented in the final report – constitute a much more rigorous and appropriate basis for the benefits analysis.

- A single weighted average cost per barrel for all barrels lightered appears appropriate for any given year. Since the barges are apparently used to serve a mix of clients, each client's business would be subject to a blended cost. In other words a single blended cost (at sea and in port) would apply to all clients and volumes in each year. As volumes and fleets changed from year to year, that blended cost would shift, but would still apply to all of Maritrans' customers.
- Over time, the cost per barrel should change:
 1. As utilization alternately reaches capacity (lowest cost, all assets fully used) and falls below capacity (new capacity added, but underutilized at first), the fixed costs of barge ownership and operation are spread over different volumes in different years.
 2. As new barges are added, each presumably the most efficient available, the average barge productivity should improve over the present mix. The fixed cost per barrel should decline and the weighted average transfer rate should rise.

- The Corps should be able to capture these factors in the lightering model in a fairly straightforward way. The bulker model already allocates cargo growth to a fleet of new vessels, adding new vessels as existing vessels fill up.

Preliminary Lightering Model Comments. Two spreadsheets were available for review: <maritrans5.xls> and <Del-Lite-Quick.xls>. Although incomplete, these spreadsheets show that considerable effort has gone into the identification and analysis of the costs of lightering. The approach, as far as it has gone, appears to be appropriate. Some concerns, however, can be noted at this stage, although they may well be corrected at a later stage.

The preliminary version of the analysis of the lightering cost model does not yet completely support the apparent conclusion that one Maritrans vessel (the Integrity) can be taken out of service. Also, the available analysis pertains to a single year; there is some concern how future years will be handled.

There appear to be issues with the assumptions regarding the utilization of vessels.

- Maritrans' lightering volume for the Without-Project condition is stated to be 70,000,000 barrels/year (this may be the base year). <Del-Lite-Quick.xls> assumes that this volume can be accommodated by the three existing vessels if each is at sea for an average of 4,128 hours/year (344 days times 24 hours times 50%) -- a total of 12,384 vessel-hours at sea. This is 177 vessel-hours/million barrels lightered.
- Under the With-Project condition, it is assumed that lightering volume decreases 31% to 48,295,144 barrels/year, and that this volume can be accommodated by two of the three existing vessels (a 29% reduction in capacity), each operating at sea for 4,128 hours/year -- a total of 8,256 vessel-hours at sea. This estimate corresponds to 171 vessel-hours/million barrels lightered, nearly the same as the Without-Project condition.
- Under the Without-Project assumptions contained in the spreadsheets, only 57% of deployment time is spent actually loading or unloading petroleum (see <maritrans5.xls>, sheet A, cells J69 through J76). If the effect of the With-Project condition is to lighten the same number of vessels, but 31% less quantity in each case, the reduction in time at sea could be as little as 18%, corresponding to 216 vessel-hours/million barrels lightered. On the other hand, if the sole effect of the deeper channel is to reduce the number of ships lightered, where the vessels not lightered are chosen randomly, sea time requirements would remain at 177 vessel-hours/million barrels. In fact, With-Project conditions imply a number somewhere between 216 and 177 vessel-hours/million barrels (some smaller vessels will not be lightered at all, other vessels will be lightered less).
- A mid-range estimate of sea time requirement may be about 197 vessel-hours/million barrels; 9,490 sea-hours in total. The spreadsheet assumes that only 8,256 vessel-hours are needed. This discrepancy calls into question the assumption that the Integrity can be removed from service under With-Project conditions.
- In addition to gross sea-time requirements, attention must be given to vessel dispatch issues. For commercial reasons, Maritrans can be expected to configure its fleet so as to offer the same average response time and queuing probability now experienced. Reducing the number of vessels reduces flexibility and responsiveness, perhaps implying deterioration in service. This subject does not appear to be addressed in the present spreadsheet assumptions.

The spreadsheets reviewed thus far appear to apply to the base year, or to some near-term year. There is no projection of future lightering cost with or without the project. In particular, there is no information on how Maritrans' fleet would be augmented to deal with increasing petroleum shipments in the future, with or without the project.

The Corps should base the reduction in lightering vessel sea time on projections of changes in the number of ships to be lightered and the reductions in quantity lightered for the remaining ships. The results of this analysis should be used to determine what changes would logically be made in Maritrans' fleet (for example, will the Integrity be kept in service? replaced with a smaller vessel? removed from service and not replaced?). Once this determination is made, the new vessel configuration will be analyzed to determine if it will lead to any significant increase in waiting time or queuing. If so, further changes in fleet configuration will be required to provide a With-Project condition that is comparable to the Without-Project condition. The Corps should also project lightering requirements with and without the project for future years, and then project fleet configurations under these assumptions. Once these issues have been dealt with the benefits from reduced lightering be estimated with greater confidence.

ACTION TAKEN (NAP 12/6):

The external review team comments have provided the framework and methodological procedure to accomplish a revised lightering analysis, based on costs and not price. Details to address the above set of comments are summarized below and presented in more detail in the benefit appendix.

An analysis of lightering costs under both without and with project conditions has been performed for the project. Vessel operating costs for both at-sea and at-port categories for the existing Delaware Bay lightering fleet were developed specifically for this study and compared to a number of maritime sources, including tug and barge companies, marine brokers, and the annually published generalized VOC's for similar vessels. Weighted average at-sea and at-port costs per barrel were developed separately for the without and with project conditions. The without project condition weighted cost per barrel was calculated based on the existing Maritrans lightering fleet.

An analysis of with project conditions was then conducted to determine whether the reduction in lightering volumes with the deepened Delaware River channel would be sufficient to eliminate the need for the least efficient of the existing lightering vessels, or to cause a replacement of one of the existing vessels with a smaller vessel. The with project condition cost per barrel was calculated based upon a reconfigured lightering fleet that was sized to handle the reduced lightering volume at a comparable level of efficiency to the without project condition. Maritrans anticipates that the channel deepening could result in a reduction of 25 to 30 percent of their total lightering volume, and the lightering of large tankers could be reduced by as much as one-third. This is consistent with the Corps analysis of with and without project conditions, which predicts a reduction in total lightering volumes of approximately 31 percent in 2008, the first year of accrual of benefits. Lightering volumes would thereafter very gradually increase from growth in crude volumes, and the analysis incorporates changes in the cost per barrel over the project life.

Maritrans indicated that they would consider the following actions in response to expected lightering decreases under with project conditions: (1) reconfigure their fleet by perhaps swapping a Delaware Bay barge with a smaller barge from the Gulf Coast fleet to optimize

vessel utilization across their total fleet; (2) raise per barrel lightering charges to help maintain revenues; (3) pursue other uses of their vessels to compensate for lost lightering volumes; or (4) if necessary, reduce the level of service.

While the actual response by Maritrans to reduced lightering volumes cannot be known at this time, the appropriate measure of NED cost savings is the reduction in resource costs needed to provide an equivalent level of service. To determine this, an analysis was conducted to first compare current lightering volumes with current fleet capacity. According to Maritrans, their Delaware River lightering fleet of three vessels currently lighter approximately 70 million barrels per year.

These without project condition results were then compared to reduced lightering volumes under future with project conditions to determine the future fleet capacity required to lighter at the same relative level of efficiency. Under with project conditions, it was estimated that total lightering volumes in the Delaware River would be reduced by 31 percent to approximately 48 million barrels in 2008 (the first year of full 45-foot channel availability to the refineries). This reduction in lightering volume indicated that the lightering tanker Integrity (which represents 29 percent of the lightering fleet capacity) could be freed for other productive uses under with project conditions, without a significant impact on remaining lightering capacity or efficiency. The detailed lightering write up is presented in pages 30-39 and 71-72 of the final report benefit appendix.

HEADQUARTERS ASSESSMENT:

The above description of the lightering cost model and detailed lightering write up in the final report **resolves** the concerns expressed by the Review Panel.

4.2 UNCERTAINTY OF LIGHTERING PRICE

Statement of Concern. If the report authors choose to continue using the Maritrans lightering price as a surrogate for lightering cost, the report will have to confront numerous serious issues regarding the basis, applicability, and stability of the cost estimate used.

Basis of Concern. The Maritrans lightering rates (\$/bbl) are pivotal to this analysis. The September report alleges that the appropriate rate is \$.35/bbl, apparently based on a single interview with Maritrans on June 11, 2002. The report also asserts that the rate has been stable, apparently on the basis of a 1995 quote by Maritrans of \$.3543.

The *only* circumstances under which the \$.35/bbl figure would be a useful measure of price are:

- All customers are paying the same price (\$.35) regardless of volume, or
- \$.35 is the weighted average rate for the volume being reduced, and the post-dredging price will not change on the remaining volume.

The report offers no information on either point.

There are two reasons for concern: the applicable existing rate (or applicable underlying cost) is almost certainly not \$.35, and Maritrans might raise the post-project rate from whatever

it is now to something higher, offsetting their loss of revenue. As the sensitivity analysis showed, either case would severely alter the benefits estimate.

Existing rates

There is no documentation to support the \$.35 rate besides the DMA interview notes, and the number is far too critical to accept on such meager evidence. DMA does not appear to have made a concentrated effort to determine or verify actual lightering rates. Maritrans has three major customers on the Delaware River: Sunoco, Coastal Eagle, and Motiva. Sunoco interview notes from June 12th state “Costs are in the \$.20 - \$.50/bbl range”, which is uselessly broad. It appears from the interview notes supplied on the CD that DMA did not ask Coastal what they were paying for lightering. There were no notes supplied on contacts with Motiva. Both Valero (page C-17) and Phillips (page C-19) had adverse economic experience with lightering by Maritrans, but it appears that neither of them was asked about the prices paid.

Maritrans says that rates range from the high \$.20s to the low \$.40s. Maritrans did not say that anyone was paying \$.35, or that it was an average of some kind, only that it was “representative.” It matters very much who is paying what rate, because the actual benefits are determined by the amount each refinery reduces lightering times the rate they were paying (assuming for the moment that rates will not change). According to the 2001 Maritrans 10K, Maritrans has multi-year contract rates with its major customers, presumably including all three refineries. Also according to the 10K, Sunoco is the largest customer company-wide, accounting for 21% of company revenue. In the ordinary course of events, we would expect the contractual agreements to entail a commitment of annual volume by the refinery in return for a lower lightering rate than they would obtain on the spot market. Other things being equal, the customer with the highest volume commitment (Sunoco) should be getting the lowest rate. Customers with lower volumes commitments (Coastal and Motiva) would pay higher rates. (Thus would explain the range cited by Maritrans.) The situation would be complicated further if the contracts incorporated a sliding scale or tapering rates for higher volumes (e.g. first XX bbl at \$.42, next XX at \$.35, and anything above that at \$.28), because the reduction would occur at the lowest marginal rates rather than at the average or representative rate. (Note: a rate taper would explain the range of rates Sunoco described.)

It thus appears unlikely that the single \$.35 rate is appropriate for the analysis, even if it were an accurate average for all Maritrans Delaware River lightering business. What should be presented are the actual rates paid by the three refineries for the volumes that would be reduced, and the expected lightering reductions for each.

Post-Dredging Rates

The effect of channel deepening will be to reduce lightering volumes. What happens when the volumes decline due to channel deepening? *With lower volume commitments, the customers should expect to see a rate increase.* Maritrans will have the same capital costs and less volume over which to spread them.

The Maritrans 10K says:

“If this project becomes fully funded at the federal and state levels and fully constructed (including access dredging by private refineries), it would have a material adverse effect on Maritrans’ lightering business.”

The DMA Maritrans interview notes say:

“Maritrans indicated that they would consider the following responses: (1) reconfigure their fleet, keeping three vessels but perhaps swapping a Delaware Bay barge with a smaller barge from the Gulf coast fleet and (2) rate increases to help maintain revenues, with the above considerations about next-best alternatives available to the Delaware River refineries”.

The DMA Coastal interview notes say:

“Coastal does not expect to benefit from channel deepening. In fact, Coastal considers it possible that their transportation costs could increase under with-project conditions. Their rationale is based upon their view of the dominant position that Maritrans has in the lightering market. Coastal anticipates that reduced lightering activity in Delaware Bay associated with channel deepening could induce Maritrans to:

- Raise lightering fees (i.e., \$/bbl) to maintain revenues in the face of declining lightered volumes, or*
- Abandon lightering operation at Big Stone Beach, forcing Coastal to invest in their own lightering equipment and operations.”*

The current benefits appendix says (page C-18):

“Coastal acknowledges that the 45-foot project could reduce their transportation costs if lightering fees remain stable and could make berth modification economical, but they expect lightering fees to increase.”

None of the parties involved said they expect rates to remain stable, and one of them says they are likely to rise. These seem to be very strong signals that rates would likely increase post-dredging. In fact, it appears unreasonable to suggest that Maritrans would simply accept the dramatic loss of revenue without attempting to raise rates to those customers who have reduced their volume commitments. It is inherently risky to substitute the opinions of the report authors for the experience and opinions of the parties involved.

The circumstances of the Delaware River operation point to a case of modified “umbrella pricing.”

- Maritrans has no direct competition from existing lightering services, and there are probably high barriers to entry for such services.
- The multi-year contracts protect Maritrans from short-term competition.
- Maritrans is free to negotiate the highest rates it can short of the threshold at which refineries would be better off starting their own lightering operations (the “pricing umbrella”).

Rate stability by itself is not an indication that price is at or near marginal cost. If anything, rate stability in a changing world is an indication of significant pricing power. It also appears that Maritrans has had some success in raising rates, casting doubts on the alleged “rate stability.”

Maritrans’ website says:

“Maritrans renewed a number of long-term contracts at higher rates in 2001.”

Maritrans's 2001 10K statement notes (page 12):

"Term contract rates renewed with customers in 2001 were renewed at higher levels than those experienced in 2000"

"These rate increases will have a positive effect on 2002 revenue."

It is not clear that these statements refer to Delaware River lightering rates, but it is quite clear the Maritrans is engaged in raising rates for some segments of its business.

The example of "rate stability" given in Section 3.5.2 has no data to back it up, since the only basis for the alleged stability is apparently the two figures given by Maritrans at different times. The example does not provide support for the assertion that Maritrans prices their services at or near long-term marginal costs.

The August version of the report stated (Page C-28):

"When the BP Trainer refinery was sold to Tosco (now Phillips 66) in the mid-1990s, Maritrans lost approximately 20 million bbl/year in lightering volume. Phillips 66 utilizes their own Eagle-class tankers to lighter Suezmax tankers offshore. In response, Maritrans raised their lightering rates to remaining customers to partially offset the resultant loss of revenues."

This statement has been deleted from the current report version. Presumably, however, there was some basis for the statement to have been made in the first place.

Significance of Concern. As the sensitivity analysis in report Table C-27 demonstrates, the lightering cost or price is a critical factor in the largest portion of project benefits.

Specific Actions Needed. If the report continues to rely on the price of lightering, the authors will need to determine the nature of Maritrans lightering contacts, specifically whether volume commitments are made in return for favorable prices or if the contracts incorporate sliding scales of prices and volumes.

- If volume commitments are made to obtain favorable rates, the analysis must compare the pre-dredging volume and rate combination to the expected post-dredging volume and rate combination, and provide a well-documented estimate of a post-dredging rate.
- If a sliding scale is used, the analysis must determine the prices applicable to the volume being eliminated, not an average or representative price.

Since it appears likely that Maritrans would attempt to raise prices in post-dredging negotiations, use of price as the variable must be accompanied by the recognition that some of the project benefits would then accrue to Maritrans and not to the refineries (per the Coastal interview notes). Alternatively, as noted above, a higher post-dredging unit price may reflect the impact of spreading fixed costs over a lower lightering volume, especially if Maritrans does not or cannot adjust capacity.

The panel understands that Maritrans has raised legal obstacles to publishing actual lightering rates. While making the correct analysis difficult, this fact does not make the existing analysis any more reliable. This stumbling block, however, is a strong argument in favor of analyzing cost rather than price.

Applicable Corps Guidance. ER 1105-2-100. Paragraphs E-10.d.(4), (5) and (6).

Corps Response:

See response to comment 4.1 above. Lightering *costs* rather than lightering *prices* will be used in the analysis and presented in the final report. A sensitivity analysis will be conducted to compare the implications of using a representative price of \$0.37/bbl in the benefit computations.

Panel Conclusion:

The use of cost rather than price avoids the pitfalls discussed above. It may be more useful to do a sensitivity analysis on an interval (e.g. plus or minus 10%) round the cost estimate. Price is still relevant, with all its complexities, for the “Reasonableness Test on Associated Costs” presented on pages 9-10 of the Addendum to the September 2002 QA/QC report.

ACTION TAKEN (NAP 12/06):

The following set of sensitivity analyses on lightering costs and prices have been included in the final report:

1. Cost of lightering operations

- Range of at-sea and at-port operating costs for the Maritrans fleet of lightering vessels
- Unchanged Maritrans fleet under without and with project conditions
- Removal of Maritrans 300 instead of Integrity from the lightering fleet under with project conditions
- Qualitative analysis of replacement of the Integrity with a smaller vessel from Maritrans Gulf fleet

2. Price of lightering operations

- Representative price of \$0.37/bbl under without and with project conditions
- Representative price of \$0.37/bbl without project and \$0.42/bbl with project

HEADQUARTERS ASSESSMENT: The above description of sensitivity analysis on lightering costs and prices and the analysis in the final report **resolves** the concern expressed by the Review Panel. The sensitivity analysis pertaining to the lightering fleet under the with project condition was demonstrated to be the most significant factor affecting economic justification of the authorized project.

4.3 QUESTIONABLE RATE OF PETROLEUM TRANSFER

Statement of Concern. The average lightering transfer rate (bbl/hr) used in the analysis appears questionable.

Basis of Concern. The enormous range of lightering rates given on page C-30 (Table C-6) is cause for concern. The report states that “Lightering time was calculated using the average of the lightering rates for the three Maritrans vessels (56,667 bbl/hr).” The three Maritrans vessels exhibit markedly different rates, with the Ocean 400 lightering almost twice as fast as the Maritrans 300. Since the benefits are calculated on a cargo (tonnage) basis rather than a vessel basis, the analysis should have used a *weighted average* of lightering rates and vessel lading, rather than the *mean* of the three rates.

The revised text discussion in the September report misses the point (confusing the issue with optimization), does not give the data for the weighted average cited, and seems inexplicably to resist using the proper measure even when it concludes that it makes no material difference (less than 0.2 percent, according to the report).

Significance of Concern. The lightering transfer rate is a key input to the tanker models and estimated lightering benefits amount to 62 percent of total estimated benefits.

Specific Actions Needed. The estimate should be redone as a weighted average. The issue of optimization is not relevant.

Applicable Corps Guidance. ER 1105-2-100, paragraph E-37.

Corps Response:

The tanker models have been revised to use the weighted average lightering rate. The derivation of this rate is shown below and is included on the Global Inputs worksheet of the “Consolidated Rev” Excel workbook.

Computation of Weighted Average Lightering Rate			
Vessel	Lightering Rate	% of Total	Weighted Avg.
Ocean 400	70,000	41.2%	28,824
Integrity	60,000	35.3%	21,176
Maritrans 300	40,000	23.5%	9,412
Total	170,000	100.0%	59,412

Panel Conclusion:

The response is the correct approach and resolves the issue. The weighted average lightering rate would be expected to vary slightly if one or more barges are initially taken out of service as lightering demand declines. As barges are added to eventually accommodate trade growth, the lightering rate would probably rise since new barges should be more productive.

ACTION TAKEN (NAP 12/06):

Lightering time under without project conditions was calculated using the weighted average of the lightering rates for the three Maritrans vessels (59,412 bbl/hr). Weighted average lightering rates under with project conditions (59,091 bbl/hr) were calculated for a reconfigured fleet consisting of the Maritrans 400 and Maritrans 300. The final report benefit analysis incorporates the revision recommended by the external review team. The above response to Comment 4.1 references the relevant pages in the benefit appendix.

HEADQUARTERS ASSESSMENT:

The final report benefit analysis which incorporates the recommendation of the external review team **resolves** the concern provided by the Review Panel.

5.0 DELAY

5.1 INSUFFICIENT SUPPORT FOR DELAY BENEFITS

Statement of Concern. The discussion of vessel delay (5.2.4, page C-55) lacks documentation or rigor and is insufficient to support an estimate of potential benefits. The review panel was unable to follow or verify the analysis of tidal delay benefits

Basis of Concern. No data on vessel delays are presented. It is unclear from section 5.2.8 whether any benefits are actually claimed for tidal delay reductions. There is no identifiable estimate of benefits from reduced delay in the report.

Significance of Concern. Benefits from reduced vessel delay are discussed and implied, but are not documented or explained adequately.

Specific Actions Needed. Given the complexity of the arrival/anchorage/lightering situation of tankers, a detailed and well-supported analysis is required to attribute any benefits to delay reductions. The analysis should include data on past delays and their causes, and evidence of the costs associated with delays and their impact on carriers. If no benefits are claimed for reduced delay, the relevant sections should be deleted rather than give the impression of significant but non-quantified benefits.

Applicable Corps Guidance. EP 1165-2-1, paragraph 7-1.b.

Corps Response:

Tide delay benefits are attributed only to vessels that have either completed lightering operations or vessels that require tidal advantage without having to lighter. Tide delay benefits do not include time spent for other reasons. Tide delay benefits are calculated as a component of time spent traveling up the channel. The final report will be modified to clarify the source of tide delay benefits and will include a table that identifies the value of tide delay benefits.

Panel Conclusion:

The suggested response should resolve the issue. As with other proposed report changes, the final version should be subject to the QA/QC process.

ACTION TAKEN (NAP 12/06): Concur.

More details explaining the methodological basis and computations for the tidal delay benefits are included in the final report benefit appendix on pages 27-28, 72, and 78-79. Tidal delays are identified as the amount of time a vessel would be expected to spend waiting for the tide to rise to a level that would allow adequate clearance for the vessel to enter the channel. The expected amount of tidal delay depends on the vessel sailing draft, the probability that the vessel arrives at

the low tide portion of the tidal cycle, and the probability of where in the low tide cycle the vessel arrives. Benefits due to reduced tidal delays result from the incremental savings due to projected vessel calls that require use of tide in the without condition, but will require less tidal use in the with condition.

Total tidal delay reduction benefits equal \$0.9 million, or 3.6 % of total benefits. Tidal delay benefits consist of two components: 1) the reduction in time spent steaming up the channel, and 2) reduction in time spent waiting at anchorage for a favorable tide. The first category is due to the additional “at sea” time required to reach the dock because the ships are traveling slower than optimal in order to “drift the tide” under without project conditions, rather than traveling at a more efficient speed. These benefits accrue to vessels that are depth constrained in the without project condition, but are not depth constrained in the with project condition. This includes tankers in the 37-42 foot draft range. For larger tankers tidal delay reduction benefits are not claimed, because these vessels would be depth constrained and would not ride the tide in both the with and without project conditions. The portion of the tidal delay reduction benefits related to reduced waiting time at anchorage are claimed for the period of time after vessels are lightered, ready to leave the anchorage, and are waiting for a favorable tide to steam to the docks.

Expected values for the time spent waiting for the tide range from 0.38 hours to 2.2 hours for vessels that require one foot to three feet of tidal availability. Vessels will continue to wait for the tide under both without and with project conditions. However, there will be fewer occurrences of vessels waiting for the tide under with project conditions, because the subset of tankers will no longer be depth-constrained and will not have to wait for a favorable tide to leave the anchorage.

HEADQUARTERS ASSESSMENT:

The above explanation and final report text changes describing tidal delay benefits along with the additional QA/QC **resolves** the concerns expressed by the Review Panel.

6.0 VESSEL BENEFITS MODELS AND INTERPRETATIONS

6.1 SPREADSHEET MODEL FEATURES

Statement of Concern. The benefits model spreadsheets appear to contain manually entered “with-project” or “without-project” benefits results, a risk-prone practice. This feature is still present in the revised models.

Basis of Concern. In many of the spreadsheets, a comparison is made between calculated benefit totals and manually entered or copied benefits totals. This is reportedly the result of the use of the same spreadsheet to produce results for different assumptions. This practice is error-prone and obstructs efforts to verify calculations.

The cost estimate pages are typically linked to the inputs pages. If the new draft (45 foot) is entered on the inputs page, the benefits will match the manually copied “with-project” summary numbers. If the old draft (40 foot) is entered, the model will yield the “without-project” number. The analyst apparently built the models, then copied the different results of 40 foot and 45 foot drafts onto the summary page. This is a risky practice. It would have been much better,

and not much harder, to copy the model pages to create two parallel models in the same workbook with a common summary page.

Significance of Concern. Although the manually entered or copied values appear valid, the practice increases the risk of error, especially as models are modified in successive versions or used for sensitivity analysis.

Specific Actions Needed. All cost and benefit models should be configured to eliminate the need to manually enter or copy results.

Although the USACE 10/17 responses to comments suggested that this would require replicating and linked the models, thereby doubling the volume of backup spreadsheets, this does not appear necessary. A review panel member was able to correct the problem in the previous version of the container model in less than an hour. (The example can be provided to USACE/DMA.) Other models may be easier or harder to correct.

Applicable Corps Guidance. NA

Corps Response:

The current versions of the spreadsheet models have been revised to eliminate copied values. The current models can be found at the following ftp site:

<ftp://ftp.usace.army.mil/Incoming/NAP/delaware%20river/October%2030%20Models/>

Panel Conclusion:

A brief review of the October 30th model versions at the ftp site indicate that the issue has been resolved. As the models have been revised in many particulars, the documentation needs a thorough revision and the spreadsheet audits undertaken as part of the QA/QC process must be updated and applied to new sheets.

ACTION TAKEN (NAP 12/02):

The models have been revised, as recommended by the external review team, and a final QA/QC process, including spreadsheet audits, has been conducted and documented.

HEADQUARTERS ASSESSMENT: The action taken **resolves** the concern expressed by the Review Panel.

6.2 BULKER MODEL VALIDITY

Statement of Concern. The previous Bulker Model is undocumented, and the review panel could not determine its validity. **Basis of Concern.** The previous final spreadsheet model for bulker-related benefits (July 31, 2002) depicted benefits due to slag and slab shipments; however the “Model Notes” page in the spreadsheet describes a *Tanker* Model. There was no documentation for the Bulker Model in the spreadsheet. The in-port and at-sea vessel operating cost factors, on which the model results depend, had no documentation or audit trail, and could not be related to Economic Guidance Memorandum 00-06.

Significance of Concern. The review panel could not verify the accuracy of the Bulker benefits.

Specific Actions Needed. The Bulker Model needed to be documented and its validity verified. Port pairs should be provided to give confidence of the origin destination draft benefits. The panel has not completed its review of the revised bulker model

Applicable Corps Guidance. EP 1165-2-1, paragraph 7-1.b.

Corps Response:

The current model includes a model notes worksheet that describes the bulker model. In the final version of the model an additional sheet will be added that shows how the constant and slope for the in port and at sea operating costs were derived from the FY 2002 IWR VOC tables.

Panel Conclusion:

Limited panel review of the revised bulker models confirms that documentation and other features have been substantially improved. Final confirmation should be part of the QA/QC process.

ACTION TAKEN (NAP 12/06):

Final model confirmation has been accomplished as part to the QA/QC process.

HEADQUARTERS ASSESSMENT: The action taken **resolves** the concern expressed by the Review Panel.

6.3 TANKER AND TERMINAL MODEL VALIDITY

Statement of Concern. Final spreadsheets for Delaware Terminal benefits and for tanker models slightly overstate the present value of benefits.

Basis of Concern. Table C-26 in the September 2002 Comprehensive Economic Reanalysis Report states that average annual benefits for Delaware Terminals are \$361,489. This value is obtained from an incorrect calculation in the spreadsheet. Present values for 51 years (2008-2058) are summed up and annualized on the basis of 50 years. The correct value, also shown on the spreadsheet is an annualized benefit of \$345,127, plus a prebase year benefit (not annualized) of \$16,362. Actually, inclusion of the pre-base year makes this 51 years of data.

Significance of Concern. The annualized values of Delaware Terminal and Tanker benefits are biased upward by 0.31 percent

Specific Actions Needed. The affected models should be corrected.

Applicable Corps Guidance. NA

Corps Response:

The comment correctly identifies that the benefits of the project are for the 50-year period of 2009-2058, plus a pre-base year benefit for 2008, brought forward to 2009, then annualized. Pre-base year benefits (which can also be termed benefits during construction) are not claimed for commodities landed at Beckett Street (blast furnace slag) or Packer Avenue (containers & steel), since these facilities are located north of the channel reaches that will be deepened by 2008. For the remaining facilities, the models calculate: 1) annualized benefits for 2008-2059, and 2) annualized benefits for 2009-2059. The difference between 1) and 2) are the annualized pre-base year benefits.

Panel Conclusion:

The Corps' explanation of the benefits annualization of this spreadsheet appears to be correct. Note that cell formulas are absent for several of the key components of this result: the numbers appearing on the spreadsheet have been copied or entered manually. Since this is an unusual computational procedure (as opposed to the more usual method of annualizing values for the 50-year project life, then separately annualizing the pre-base year), the spreadsheet should include formulas, or the method should be explained in the report. Here again, final QA/QC review is needed to confirm that all necessary changes have been made and documentation updated.

ACTION TAKEN (NAP 12/06):

The final QA/QC review has confirmed that all the necessary changes have been made and the documentation has been updated.

HEADQUARTERS ASSESSMENT: The action taken **resolves** the concern expressed by the Review Panel.

6.4 CONTAINER MODEL VALIDITY

Statement of Concern. The previous Container Model (Final Container Model July 31 2002.xls) appeared to be largely invalid. The revised Container Model (Containers 22Sept02.xls) is vastly improved over the previous version, as it no longer confuses the various operators and their services. There are several serious issues remaining, however, and the model cannot be regarded as reliable or valid in its current state.

Basis of Concern.*TEU Estimate and Cargo Projections*

The 2003 TEU estimate (1116 TEU per call in 2003) was apparently derived from an interview with ocean carrier representatives. There is no explanation, documentation, or background for this estimate, and no reconciliation with the DRI-WEFA cargo forecasts is offered. Since the benefits report does not give TEU forecasts either in the body or the appendix, the forecasts in the model cannot be compared to the DRI-WEFA forecast. In the absence of

adequate documentation, this critical number cannot be verified and cannot be regarded as a reliable basis for forecasts or benefits estimates.

The growth factors applied to the TEU estimate are likewise undocumented. While the difference between these factors and the DRI-WEFA factors is small, the difference must be explained. Moreover, there is not justification offered for the application of these particular growth factors (apparently for overall containerized cargo) to the estimate of TEU per call (consisting primarily of imported frozen meat).

Vessel Cost Factors

The EGM gives capital costs for a typical 4,000 TEU 7-year-old foreign flag containership at \$59,486,840. Industry sources suggest that the actual cost of the new P&O Albatross class vessels (e.g. the Remeura and the Encounter) would be closer to \$40,000,000. If so, using the EGM figures would be overstating the capital costs by almost 50%. In cases involving numerous lines deploying dozens of different vessels a “typical” cost for a seven-year-old vessel might be defensible, but in this case there are specific new vessels and the analysis should use their actual cost. The actual cost may take some work to find, since these vessels are chartered by P&O Nedlloyd rather than owned, but a “typical” figure is not acceptable. Standard Corps practice appears to be inapplicable in this case.

Sailing Costs vs. Total Costs

The joint service RTW service announced by P&O Nedlloyd, Columbus Line, *et al* would use ten vessels calling on a fixed day-of-the-week service every seven days, implying a 70-day total voyage length. Each vessel would make an average of 5.2 trips annually. The anticipated change in vessel calls to make Savannah first would save roughly 31 hours of sailing time on each eastbound voyage (westbound voyages use smaller vessels that would not benefit), or about 162 annual hours per vessel. The model counts the total vessel costs at \$1,691.24 per hour as benefits.

In order for capital costs to be saved and counted as benefits, one of the following things must be true:

- The vessel owners can take one or more vessels out of the string;
- The vessel operators can make additional voyages with the same vessels; or
- The vessel operators can use the 31 hours per voyage for some other productive purpose.

The report does not demonstrate that any of these options can be realized, and an assumption that the operators can choose among these options appears unwarranted:

- A savings of 31 hours on a 70-day voyage is not enough to take a vessel out of the string. The ten vessels need to make 52 annual weekly calls. Cutting the voyage to about 69 days will not let them do it with 9 vessels (with a 69-day voyage, 9 vessels can make only 48 annual calls), unless they choose to skip port calls or take some other action unrelated to the channel deepening project (e.g. the project may be necessary but not sufficient).

- The operators cannot make more voyages without abandoning fixed day-of-the-week calls. A major objective of liner services is to attain sufficient volume to justify fixed day-of-the-week service, and many major customers expect and demand such service. If the new service calls on Tuesday, for example, shaving a day off the voyage would mean moving up the vessel call one day every ten voyages. It is very uncommon for a vessel operator to disrupt fixed day-of-the-week service in this manner, and the report would need convincing evidence to accept such an argument. (The model actually anticipates this in the later years when cargo increases beyond vessel capacity, but this may be an acceptable surrogate for the more complex analysis of additional service deployments, which would be necessarily speculative.)
- The time savings appears insufficient for other purposes. Saying that the vessel operators would find something to do with the extra time is not enough, and ignores the realities of liner service with scheduled port calls.

Vessel operators will indeed be happy to have the additional time in the voyage, and they will optimize the saving through either reduced sailing time or slower steaming and reduced fuel consumption. The most appropriate way to represent this in the model would be the difference between hourly sailing costs (about \$1,671 according to the EGM) and hourly port costs (about \$998, according to the EGM), or about \$673 per hour (versus \$1,691.24 used in the model). If USACE/DMA want to count fixed cost savings as benefits they will have to demonstrate, not speculate, how such savings could be achieved.

Significance of Concern. All container shipping benefits are derived from this model, and are subject to serious questions.

Specific Actions Needed. The Container Model requires significantly more documentation and justification.

- The per-call TEU estimate needs to be documented and compared to both historical data and DRI-WEFA forecasts in common terms (TEU of the same commodities in the same trades).
- TEU growth factors must be explained and demonstrated to be applicable to the TEU estimate.
- The methodology behind the cost factors must be explained and an audit trail established to the VOC EGM cited.
- Capital costs should reflect the specifics of the vessels involved.
- Either the benefits should be recalculated as the difference between sailing cost and port cost for the time saved, or a convincing analysis supplied to justify the fixed vessel cost savings. Preferably, report authors should have confirmation from vessel operators on the reasonableness of their scenarios.

Applicable Corps Guidance. EP 1165-2-1, paragraph 7-1.b. and ER 1105-2-100, paragraph G.9.h.(3).

Corps Response:

A worksheet will be added to the model that identifies the regressions used to interpolate or extrapolate the Corps' vessel operating costs for each vessel type. The vessel cost cells on the model's input page will refer to the appropriate regression results, as recommended.

As discussed in a previous response, the VSA consortium market share will be estimated and used to validate vessel sailing drafts, Packer Avenue Terminal TEU forecasts, and vessel utilization.

The capacity of individual vessels will be explicitly accounted for in forecasting the number of calls to Packer Avenue.

The costs of the Albatross Class vessels will be based upon the same vessel operating cost regressions used for other vessels but a sensitivity analysis will be added to assess the impacts of lower capital costs for these vessels as reflected in the current newly built costs in Asian shipyards.

The full cost (capital and operating costs) of the Albatross Class vessels will be used in the transportation cost savings calculations. The vessel transit time saved under the with-project condition is expected to be used by the carrier as an opportunity to add production capability to the service. Discussions with the carriers indicate that the most likely use of this time savings would be to add another port of call on the service. Identification of the specific port of call cannot be made at this time.

Panel Conclusion:

If implemented as described, documented, and subjected to appropriate QA/QC checks, the proposed approach will resolve the issue. In particular, discussions with carriers and others need to be documented.

ACTION TAKEN (NAP 12/06):

The recommended approach by the external review team, and the above Corps listing of additional work efforts, have been applied in the final report benefit analysis. Discussions with carriers and other relevant sources have also been documented. The container benefit analysis is presented on pages 22-25, 51-53, 66-68, and 76-81.

A sensitivity analysis of the construction cost of the Albatross vessel class has also been accomplished. A weighted average cost per vessel of \$52 million has been applied, based on the reported construction costs of delivered vessels.

HEADQUARTERS ASSESSMENT: The final report text and the above explanation resolves the concerns expressed by the Review Panel.

6.5 VESSEL OPERATING COSTS

Statement of Concern. The review team was unable to reconcile the costing approach used in the vessel cost models with the latest version of the VOC EGM from the Corps.

Basis of Concern. The container model, for example, incorporates what it calls “*Factors used to calculate hourly costs at sea (using DWT); source = EGM 02-02 equation for the line running through the FY2002 foreign flag Containership DWT and at sea cost data points*”. There is no such equation in the EGM, so it appears that the equations were developed by USACE/DMA for this report. The costs seem to be close to the EGM figures for the 4,000 TEU foreign flag container ship and may be reasonable, but they cannot be verified from the Container Model documentation. The Bulker model incorporates a similar approach.

Significance of Concern. Vessel operating benefits are derived from these models, and the cost calculations are the basis of the benefits.

Specific Actions Needed. The methodology behind the cost factors must be explained and documented and an audit trail established to the VOC EGM cited. A separate memorandum may suffice, or if the equations were developed in Excel spreadsheets those spreadsheets could be added and linked to the relevant model workbooks.

Applicable Corps Guidance. ER 1105-2-100, paragraph G.9.h.(3).

Corps Response:

The reviewers are correct – the equations were derived from the tables contained in the EGM so that VOCs could be interpolated for vessel sizes not included in the 2002 EGM tables. The constants and slopes for each vessel category were derived using the LINE_EST function in Excel. This worksheet will be added to each analytical model workbook so that the derivation of the values and links can be checked.

Panel Conclusion:

If implemented as described, documented, and subjected to appropriate QA/QC checks, the proposed approach will resolve the issue

ACTION TAKEN (NAP 12/06):

The appropriate worksheets have been added to each appropriate model and approved in the QA/QC process for the final analysis.

HEADQUARTERS ASSESSMENT: The action taken **resolves** the concern expressed by the Review Panel.

6.6 BROADKILL BEACH DISPOSAL BENEFITS.

Statement of Concern. Benefits appear to be claimed for new construction disposal as it relates to storm damage reduction at Broadkill Beach. The benefit claimed is for beneficial use of dredged material associated with storm damage reduction.

Basis of Concern. The concern with this benefit category is a question of whether or not storm damage reduction could also be achieved in the without-project condition – specifically with maintenance-dredged material during maintenance cycles.

It appears to the review panel that the Broadkill Beach storm damage reduction project would need periodic maintenance, which if achieved through maintenance dredging could be a least cost application for both the with and without project condition as well.

In addition, it appears that the storm damage reduction project (a separate project or a separable element of the deepening project) is relying on beach sand. If this is the case, then it appears that there is a recreational use associated with the type of material (sand). A recreational aspect of disposal, if more expensive than the least cost disposal due to type of dredging, distance transported, or type of placement material, is a non-Federal cost share obligation. Storm damage reduction should not be a function of the type of dredged material unless the properties of the material affect the cost of the construction. But even in this case, if the project required more maintenance type of material than sand to achieve a certain level of protection it would benefit the without project maintenance cost.

Significance of Concern. Although (based on table C-26 supplied by HQUSACE), the storm damage reduction benefit claimed only amounts to approximately 2 per cent of the total claimed project benefits, it may not be eligible for inclusion.

Specific Actions Needed. The report needs to clearly demonstrate that maintenance dredged material (either totally or in part) is not suitable for storm damage reduction construction and subsequent maintenance. If the benefits cannot be substantiated, they should be eliminated or reduced to the extent that the same benefits can be achieved without the project.

Applicable Corps Guidance. EP 1165-2-1, paragraphs 5-6.a. (3) and (4).

Corps Response:

The guidance provided by HQ was that if disposal of navigation materials on Broadkill was the least cost alternative, the benefit should be the lesser on an annualized basis of storm damages prevented and the reduction in costs of construction of the authorized project. In accordance with the guidance, the cost of the Broadkill offshore sand source (\$9.7 million) was determined to be the appropriate measure of benefits. With the least cost option determined, \$9.7 million in avoided borrow area sand source cost is a benefit to the project. On an average annual basis this is equal to \$626,200.

Concerning the magnitude of material suitable from maintenance dredging, about 92,000 cubic yards are dredged annually in this reach of the project area. About 1.3 million cubic yards are needed to be placed at Broadkill Beach. Consequently, the maintenance quantities are inadequate for beneficial use at Broadkill Beach.

Panel Conclusion:

The Corps' response to the query on the use of maintenance dredging spoil is not yet complete. While the total beach replenishment project may require 1.3 million cubic yards, the important issue is how much sand will be used for this purpose each year.

- If some or all of this material can be provided by maintenance dredging under With-Project conditions, then it is not appropriate to replace that material with project spoils. Between 2002 and 2009, about half of the 1.3 million cubic yards could be supplied through maintenance dredging at the stated annual rate of 92,000 cubic yards. If it is feasible to do so, then project costs may need to be recalculated.
- The storm damage reduction project has apparently been approved but not yet implemented, implying that there is some more beneficial or less costly disposal method for dredging spoils at present.
- The effect of this condition, if it exists, may be to require more costly disposal for at least some of the sand now allocated to Broadkill Beach, raising project costs.
- If use of maintenance spoil is not feasible due to economies of scale, spoil quality, location, etc, then the report should explain these factors.

The panel's original comment pertained to the allocation of avoided costs to the Broadkill Beach project, and affected the benefit cost ratio for this separable project alone. The way in which the Corps chose to allocate avoided costs did not affect benefits or costs for the channel deepening project as a whole, assuming that Broadkill Beach project is included as planned. However, it is not clear that the beach project is properly included, pending clarification of the issues raised above. If some or all of the beach replenishment is feasible under without-project conditions (i.e., using maintenance dredging spoil), then overall project costs have been understated.

ACTION TAKEN (NAP 12/06):

The use of dredged material from the ongoing operation and maintenance 40-foot deep channel (Option 1) would cost significantly more than using dredged material from initial construction of the 45-foot channel (Option 2). Further, Option 1's completion date would be approximately 21 years later than Option 2.

Here is the comparative analysis:

Under Option 2, the initial 45-foot channel construction (year 3), calls for approximately 2.2 million cubic yards of material to be placed on Broadkill Beach at a total cost of \$27 million. Please note that in our previous response 1.3 million cubic yards was inadvertently referenced instead of 2.2 million cubic yards.

Under Option 1, maintenance dredging of the existing 40-foot channel would supply only 92,000 cubic yards of material annually for use on Broadkill Beach. The annual cost to dredge and place the 92,000 cubic yards would be \$1.535 million. In addition, Option 1 would require approximately 24 years to place 2.2 million cubic yards of material on Broadkill Beach at an aggregated cost of \$36.8 million (24 years X \$1.535 million). The annualized cost for this placement of \$1,526,000 ($\$1,535,000 * ((USPW,24) 12.6235) * ((CRF,24) 0.078761)$) would be in excess of the claimed average annual benefit of \$604,700. Assuming dredged material is

first placed on the beach in the year 2003, the required 2.2 million cubic yards would not be completely placed on the beach until the year 2026. The significantly higher cost and extreme length of time under Option 2 eliminates it as a viable option.

Furthermore, Option 1 is not considered technically viable. From a coastal engineering perspective, using repeated small amounts (92,000 cubic yards) would be subject to erosion and would not sustain a beach. Even if it were technically viable, it would not serve as a reasonable substitute for the basic initial construction of the authorized beach project.

In conclusion, the benefit analysis is based on costs foregone. If the Broadkill sand is not obtained from the Delaware River channel deepening, it would need to be obtained from an alternate borrow site at a cost of \$9.7 million. The average annual cost foregone (or benefit) is equal to \$604,700.

HEADQUARTERS ASSESSMENT: The concern expressed by the EIRP was whether or not storm damage reduction could be achieved in the without project condition by way of placement of maintenance-dredged material. The answer to this basic question is (No). The annual volumes of maintenance-dredged material that is within reasonable proximity to Broadkill are about 92,000 cubic yards. With such small volumes, it is less expensive to the navigation project purpose to dispose of this material at an existing aquatic disposal site. In addition, such small volumes placed at Broadkill would not provide any effective SDR and would be washed away between dredging cycles. Therefore, in the without project condition, it would not be a cost effective means to place maintenance-dredged materials at Broadkill Beach. However, in the with project condition, considering the volume of the initial channel deepening materials in proximity to Broadkill, the placement of 2.2 million cubic yards of material at Broadkill is the least cost disposal option as it does not require new construction for upland confined disposal sites. .

6.7 BARRELS PER METRIC TON CONVERSIONS

Statement of Concern. The lightering models are expressed in metric tons, and convert the Maritrans rate of \$0.35 per bbl to \$2.5661 per metric ton. The conversion factor is shown incorrectly in the documentation and is not sourced.

Basis of Concern. The lightering cost is shown as \$2.57 per metric ton (actually \$2.5661...) in cell B12 of the Global Inputs sheet in Consolidated Rev Sept19.xls, and is referenced by other spreadsheet models. The documentation says “*Hourly lightering cost; source = Maritrans representative cost (\$.35/bbl at 7.3529 bbls per metric ton)*”. Were that true, the value would be \$2.574 per ton. In fact, the formula shows that the conversion factor used was 7.33176069293178, which is the conversion factor for St. Eustatious/St Lucia shown on the following sheet of the same workbook. The difference is only 0.3%, but the discrepancy raises the question of the conversion factor in general. Table C-7 on report page C-31 lists the numerous different conversion factors but neither the actual use of the St Eustatious/St Lucia rate nor the purported use of 7.3529 is justified or supported.

Significance of Concern. Although the discrepancy in the model may not be material, the value used remains unsupported and is potentially material as it directly affects the estimate

of lightering savings. Based on the range of conversion factors in Table C-7, the equivalent price per metric ton could range from \$2.478 to \$2.675, an 8% difference in price and in lightering benefits.

Specific Action Needed. The proper conversion factor needs to be calculated and incorporated in the models, and the documentation corrected. The correct conversion factor would be the weighted average for the volumes lightered, recognizing that the mix of crude sources on tankers that require lightering would not be the same as the overall mix. This may be another reason to do the analysis in barrels rather than in metric tons.

Applicable Corps Guidance. ER 1105-2-100, paragraph G.9.h.(3).

Corps Response:

The comment correctly identifies an error in the lightering model. The tanker models have now been modified to base lightering costs on a per barrel, rather than per ton, price [please note response to Comment 4.1 – lightering *cost* will be substituted for *price* in the final model once the IWR computation of Maritrans’ lightering fleet vessel operating costs are completed]. The conversion from barrels to metric tons now references a table in the Consolidated tanker model that contains the country specific conversion rates, which are applied to each lightering operation, based on country of origin.

Panel Conclusion:

If implemented as described, documented, and subjected to appropriate QA/QC checks, the proposed approach will resolve the issue

ACTION TAKEN (NAP 12/06):

The appropriate adjustments for conversion factors have been accomplished and reviewed and verified in the QA/QC process.

HEADQUARTERS ASSESSMENT: The action taken **resolves** the concern expressed by the Review Panel.

7.0 RISK AND UNCERTAINTY

7.1 INADEQUATE ANALYSIS OF RISK AND UNCERTAINTY

Statement of Concern. The risk and uncertainty analyses performed on project costs and benefits are inadequate.

Basis of Concern. Since few of the assumptions or calculations associated with benefits or costs lend themselves to quantitative estimates of risk, the report employs a sensitivity analysis approach to exploration of uncertainty. In these circumstances, this is a reasonable approach. However, the number of scenarios examined is insufficient, and the method of analyzing them is imbalanced. For example:

- Uncertainty in project costs is characterized in terms of four alternative dredging cost assumptions, three of them substantially favorable to the project, and one slightly adverse. There are no alternate calculations for disposal cost, for possible unplanned environmental mitigation activities or for uncertainties in the cost of the beach replenishment project (such as a change of location). Admittedly, some uncertain future costs are stated to be included in cost “contingencies” but to do so defeats the purpose of risk and uncertainty analysis.
- Sensitivity analysis for benefits includes consideration of five alternative scenarios for lightering charges. As noted elsewhere, this issue could be largely resolved by a better analysis of avoided lightering costs in the first place (by analyzing costs rather than prices), so it need not be dealt with in this way.
- Alternate forecasts of crude oil import growth rates are also considered, but these do not include a negative growth rate (if, for example, one or more refineries become technologically or economically obsolete and are taken out of service and replaced with capacity elsewhere in the U.S.).
- Assumptions regarding bulk vessels to be used for steel slabs and furnace slag determine the size of attributable benefits, yet the sensitivity of those benefits estimates to the vessel assumptions is not addressed.
- The treatment of uncertainty ignores the commodity volume estimates and growth rates for furnace slag, steel slabs, and container cargo, the lightering transfer rates, and the container vessel deployments.

The limited sensitivity analysis presented in Table C-27 confirms that the project is very risky, since its justification turns on a single poorly documented number – the lightering price – under the influence of a single firm.

Significance of Concern. The vast majority of the benefits are related to crude oil imports and lightering. This essentially relates the fate of the project to a single large commodity flow and vessel operation, which should emphasize the importance of a more penetrating risk and sensitivity analysis.

Specific Actions Needed. The treatment of risk and uncertainty would benefit from a broader scope that reflected the multiple sources of risk specific to this project, and from a more rigorous analysis of alternative scenarios. Generally all significant but uncertain assumptions should be incorporated into the sensitivity analysis, and the overall evaluation should consider uncertainty in benefits and costs at the same time. One strategy would be to create a small number of scenarios, each of which incorporates a number of alternative assumptions (high construction cost scenario, low regional growth scenario, high regional growth scenario, etc.). At a minimum, the sensitivity analysis should consider the range of possible outcomes for:

- P&O Nedlloyd/Columbus Lines export container cargo volume in 2003
- Furnace slag imports
- Steel slab imports
- Growth rates for all benefiting commodities

- Lightering transfer rates
- Container vessel deployments

Applicable Corps Guidance. EP 1165-2-1, paragraph 5-7.e and ER 1105-2-100, paragraph E.4.c. and E.10.a.

Corps Response:

Additional sensitivity analyses will be conducted for each major commodity group showing the impacts on benefits for different ranges of commodity projections. Regarding the first five bullets in the comment:

- The scenarios selected for uncertainty analysis in project costs were based on an independent review of the project cost estimate that proposed several alternative configurations of plant and equipment to conduct the dredging project, as well as different utilization and efficiency rates for this equipment. Costs were then developed for these alternative scenarios. Because project plans and specifications would allow bidders to use these different configurations of plant and equipment (but does not specify that they do so) it was decided to include these in a sensitivity analysis. Based on coordination with the regulatory agencies and project sponsor the uncertainties concerning alternative disposal costs, environmental mitigation, and beach replenishment have been resolved.
- As stated in the response to comment 4.1, the reduction in lightering benefits for tankers are being recomputed based on costs, rather than prices. Therefore, the previous sensitivity analysis on various price combinations will be removed and the only sensitivity analysis that will be conducted on price will show the impact of using Maritrans' stated representative price (rather than cost) in the analysis.
- The crude oil growth rate sensitivity analysis will be revised to include a negative growth rate at the lower end of the range of values.
- A sensitivity analysis will be conducted on the selection of new vessels to be added to the bulker fleet to handle future commodity growth.

As stated previously, sensitivity analyses will be conducted on growth rates for all benefiting commodities.

Panel Conclusion:

The expanded treatment of risk and uncertainty proposed in the Corps response will alleviate much of the panel's concerns. The new lightering models should be subjected to sensitivity analysis regarding its own internal assumptions and outcomes. As with other changes, QA/QC review should be undertaken to verify that the proposed responses have been implemented.

ACTION TAKEN (NAP 12/06):

To fulfill the external review conclusion to expand the treatment of risk and uncertainty, the final report analysis has greatly expanded the range of sensitivity analyses conducted. Appropriate QA/QC has also been accomplished through to the final report. Complete details of the sensitivity report section are presented on pages 82 through 95 of the benefit appendix. Major sensitivity categories considered were:

1. Commodity growth rates
2. Cost versus price of lightering operations
3. Container ship operating costs
4. Dry Bulk Fleet Scenarios
5. Timing of some refinery associated cost berth improvements

Commodity growth scenarios of no growth, starting year benefit tonnage, and a higher growth alternative bracketed the most likely scenario to present alternative BCR's. Cost versus price for lightering operations reduced benefits for the most likely scenario in the final report. The impacts of potential changes to the other categories were also quantified.

HEADQUARTERS ASSESSMENT: At the recommendation of the External Independent Review Panel (ERIP) and in accordance with Corps regulations, extensive sensitivity analysis were conducted and presented in the December 02 report. The sensitivity analysis was both quantitative and qualitative, as discussed in Appendix C – Benefit Analysis (Section 6). The headquarters review team finds that the most critical assumption affecting overall economic feasibility pertains to the size and makeup of the lightering fleet in the with-project condition. In the report, the District made the assumption that the highest-cost lightering vessel would be taken out of service. If, on the other hand, the lightering service chooses to remove from service a vessel with a lower cost basis, the sensitivity analysis indicates that the project remains marginally justified. However, if there is no change in the lightering fleet in the with-project condition, the economic justification of the project could be jeopardized. The report further points out that, based on the understanding of the District analysts (including their consultants and independent reviewers) of the lightering fleet operations and costs, the alternative assumptions employed in the sensitivity analysis in this regard are not likely. As the Army and Corps decision makers are being made of the situation, this issue **is resolved**.

7.2 VULNERABILITY OF BENEFITS TO ACTIONS OF INDIVIDUAL DECISION-MAKERS

Statement of Concern. The benefits of the project rest on the ultimate actions of a very small number of decision-makers rather than on broad-based industry trends. The existing analysis does not address the volatility of some cargoes or the potential for significant changes in carrier policies and operations.

Basis of Concern. Implicit in conventional analyses of shipping trends and operations is the assumption that the trends dictate the behavior of the numerous firms involved. This is analogous to the “law of large numbers” in statistical analyses. Large ports typically serve numerous ocean carriers and a multitude of commodities and customers. Under those conditions, individual carrier or shipper decisions are relatively insignificant in the larger aggregate market.

The scenario of the reanalysis, on the other hand, seems inherently fragile since it depends on decisions by only a few individuals rather than on broad trends in maritime industry.

- There is only one non-refiner in the lightering business, Maritrans, and the entire lightering reduction benefits estimate depends on this independent company's productivity and pricing policies.
- The estimate of container benefits rests solely on assertions regarding post-dredging vessel rotation changes by just one planned joint service. The container cargo at stake is dominated by just one commodity: imported meat from Australia/New Zealand. Reportedly, one major carrier in the Australia/New Zealand meat trade – ANZDL – eliminated direct Philadelphia calls in favor of rail service from the West Coast within the last few years. A similar decision by P&O Nedlloyd/Columbus would void the container benefits.
- The bulk commodities at issue, furnace slag and steel slabs, are controlled by a small number of customers whose behavior is not statistically predictable.

Under these circumstances, it is insufficient to rely on ordinary statistical techniques or sensitivity analysis. The report seems to speak with certainty, while the spreadsheets show volatility and variance in the amount and trend of the trade. For example, in the oil market, this was handled by not projecting much increase, while, in reality, the certainty of even sustaining the volume is not addressed.

Significance of Concern. The entire benefits analysis depends on the behavior of handful of firms. Changes in any one of these factors could have dramatic impacts on the benefits estimates.

Specific Actions Needed.

- The risk and uncertainty analysis should address the history of carrier service at Philadelphia and neighboring ports, determine the reasons for carrier entry, exit and service changes and consider the impact of such changes on the benefits estimate.
- The analysis should review the cargo history of the Delaware River ports, determine the reasons behind past fluctuations and assess the likelihood and impact of future fluctuations.
- The analysis should also address the volatility of the trade in some of the commodities, particularly imported meat, imported steel, and imported furnace slag.

The response to the previous comments about this concern focused on the number of benefiting *facilities*, which is not relevant.

Applicable Corps Guidance. ER 1105-2-100, paragraph G-9.g.(1)(f).

Corps Response:

We agree that the benefits are subject to the actions of a very small number of decision-makers. This is generally the case for navigation improvements at major harbors, since incremental deepening of these already deepwater ports typically benefit only a small number of major carriers and commodity groups that use the largest liquid bulk, dry bulk and container vessels.

The report will be revised to address this additional area of uncertainty. Specifically, the following information will be added to the report:

- The risk and uncertainty analysis section of the report will be revised to explicitly state this area of vulnerability and will address it qualitatively;
- Historical commodity movement data will be added to the relevant sections of the report and the reasons for past fluctuations discussed;
- The impacts on project justification of major dislocations/ disruptions in each benefiting commodity groups will be evaluated quantitatively in additional sensitivity analyses and the probability that these disruptions will occur will be addressed qualitatively.

Panel Conclusion:

If implemented as described, documented, and subjected to appropriate QA/QC checks, the proposed approach will resolve the issue. The revised report text should cover all of the bullet items identified under Specific Actions Needed above.

ACTION TAKEN (NAP 12/06):

The final report writeup on pages 93 through 95 has covered the items identified under Specific Actions Needed. Appropriate QA/QC has also been accomplished in sequential review through report development to final report completion. The long-term operation of refineries (with modernization capacity upgrades during recent ownership changes), recent substantial port investment at bulk facilities and the intermodal container facility, and the historic designation of Philadelphia as a U.S. East Coast load center port by the benefiting P&O Nedlloyd container line all verify the confidence in the long-term operation of the benefiting facilities. Also, the routing change for the container line with the deepened channel will be an efficient procedure to maximize efficiency of operations for its round-the-world service.

HEADQUARTERS ASSESSMENT: The final report address in largely a qualitative sense the sensitivities and uncertainties of project benefits attributable to the actions of a limited number of local decision makers involved with various aspects of the shipping, marketing and usage of potentially benefiting commodities. The additional analyses **resolve** the concerns expressed by the Review Panel. One particular area of interest in the qualitative analysis is the assumptions regarding expected port rotation practices for the new containership, vessel sharing agreement (VSA), service from a consortium of carriers (P&O Nedlloyd, Columbus Lines, Hamburg-Sud, Contship, and others. If the port rotation from Australia/ New Zealand involving a Philadelphia stop before Savannah en route to Europe does not materialize as anticipated by the shipping lines, significant, but yet unquantified benefits could still accrue to a deepening of the Delaware River. However, the potential benefits would more likely be characterized by changes in fleet to more efficient vessels or greater loadings and fewer vessel trips as opposed to the distance and

time savings benefits which are estimated in the current analysis. A different economic model than the one employed in the current report would have to be developed. The HQ review team believes that such additional analysis would not adversely affect overall project justification.

7.3 LOW COST ESTIMATE CONTINGENCIES

Statement of Concern. Given the overall riskiness of the benefits estimates, it appears especially appropriate to identify sources of risk and uncertainty in the costs estimates as well. A brief review of the cost information in Appendix A suggests that very low contingency factors were used in the cost estimates.

Basis of concern. As the table below shows, the cost estimate contingencies were generally below 10 percent, smaller than the review panel would have expected and implying unusual confidence in the accuracy of the initial cost estimate.

Initial Construction Cost (1) May 2002 Price Level				
Contract Number	Description	Initial Construction Cost Estimate	Contingency Estimate	Contingency Percentage
1	Dredging Reach C	\$10,536,184	\$690,946	6.6%
2	Kelly Island Wetland/Restoration Project	\$34,632,794	\$2,694,350	7.8%
3	Disposal areas (Raccoon Island, 15G and 15D)	\$8,052,034	\$715,453	8.9%
4	Dredging Reach D	\$25,508,888	\$1,719,437	6.7%
5	Rock Excavation Reach B	\$12,633,873	\$2,561,079	20.3%
6	Broadkill Beach	\$25,155,538	\$1,860,894	7.4%
7	Dredging Reach B	\$17,225,874	\$1,147,721	6.7%
8	Egg Island Wetland/Restoration/Protection Project	\$30,644,399	\$2,329,259	7.6%
9	Dredging Reach AA/A	\$28,395,491	\$1,917,516	6.8%

(1) Cost includes Engineering and Design (E&D) and Supervision and Administration (S&A) during construction.

Significance of Concern. The seemingly low contingency percentages for the cost estimates could leave the project vulnerable to unanticipated cost overruns. Given that the net project benefits are currently estimated at just over \$4 million and that the amount of benefits has been called into question, USACE runs a significant risk of approving a project that is cost-beneficial on paper and not in implementation.

Applicable Corps Guidance. ER 15-1-36, paragraph 4 and ER 1110-1-1300, paragraphs 8.c. (3) and (4). The latter states, "All project cost estimates... will be developed with appropriate contingencies based on... cost risk analysis."

Corps Response:

Contingencies used in the current cost estimate are fair and reasonable for this stage of the planning process. For projects at the pre-construction stage, according to ER 1110-2-1302, page D-9 guidance, should have a contingency of around 10%. The current estimate includes a contingency amount of \$15,636,656 or 8.1% of the total initial construction cost.

The contingencies for new work excavation are associated with pipeline dredging, hopper dredging and rock dredging. The contingency for pipeline dredging is lower than 10% because the District has had a lot of experience in dredging the Delaware River Channel and has accurately estimate project costs with the selected contingency value. The hopper dredging estimate also includes a contingency less than 10% and reflects the conservative nature of the hopper dredging estimate (i.e., larger hopper dredges could perform the work than the one assumed and a relatively low hopper load was used.) A large contingency (considerably more than 10%) was used for rock dredging. Overall, the contingency used is reasonable given the considerable experience of the District in estimating new (advanced maintenance) and maintenance dredging. In this regard, conditions in the Delaware are a little different than other ports where some of the proposed areas for deepening have either never been dredged in the past or consist of hard dredging (rock and/or glacial till).

Disposal area costs and contingencies are based on available historical data for constructing Federal upland confined upland disposal areas including dike construction as part of the existing Federal Philadelphia to the Sea project.

Mobilization and Demobilization contingencies are fair and reasonable based on our previous experience with dredging contracts. The mobilization travel distances in the hopper dredge estimate have been further increased over our normal travel distance to accommodate an increased availability of hopper dredges.

As a result of the above, we have determined that the contingency factors applied are supported by specific and substantial operating experience and practice. These factors are fair and reasonable and need not be changed for this project modification.

Panel Conclusion:

The answer above is basically the same as that provided in response to an HQUSACE comment on the same subject in the QA/QC report. A more detailed explanation addressing the rationale for the deviation from expected contingency estimates on a contract-by-contract basis would strengthen the report as a stand-alone document.

An informal panel assessment suggests that the difference between the low contingency estimates described above and the higher estimates expected in general is not likely to alter the present value of project costs and benefits appreciably. The Corps should consider, however, whether the recent withdrawal of the disposal permit by the State of New Jersey would have significant project cost consequences, and whether contingency estimates are adequate for an event of that kind.

ACTION TAKEN (NAP 12/06):

In order to address the above concerns, a risk analysis has been prepared for two representative dredging cases, namely, the hydraulic pipeline dredge estimate for Reach C in Contract Number 1 and the hopper dredge estimate for Broadkill Beach in Contract Number 6. The rock dredging

in Contract Number 5 already includes a contingency of 20.3% contingency so further risk analyses are unwarranted.

The pipeline dredge estimate was computed using risk analysis by providing statistical distributions for dredge material factors for mud and silt as well as loose sand. The existing estimate uses a factor of either 2.5 or 2.0 for mud and silt, a factor of 1.1 for loose sand. The risk analysis was prepared assuming a triangular distribution with minimum, most-likely and maximum factors of 2, 2.5 and 3.0. Similarly, a triangular distribution (minimum = 1, most likely = 1.1 and maximum= 1.1) was used for loose sand.

Results of the risk analysis produced unit costs ranging from \$1.82 to \$2.55 as compared to the presently reported value of \$2.26. The contingency used for Contract 1 was 6.6%, which applied to the \$2.26 value, corresponds to a unit cost of \$2.41. The risk analysis indicates this contingency corresponds to a 92% confidence level that the estimated cost with contingency is not exceeded.

The hopper dredge estimate was also computed using a risk analysis that included statistical distributions for: (1) effective hopper size, (2) hopper pump-out rate, and (3) turn time. The fixed value of 1,900 cubic yards (cy) for hopper size was replaced by a triangular distribution with minimum, most-likely and maximum values of 1,600 cubic yards, 1,900 cubic yards, and 2,800 cubic yards, respectively. These values are based on estimates for existing dredges rather than a generic average dredge. The 4,200-cy/hour hopper pump-out rate was replaced with a triangular distribution characterized by a minimum of 4,200 cy/hour, a likely value of 4,200 cy/hour and a maximum of 4,500 cy/hour. Again this distribution is based on the characteristics of actual dredges rather than the generic average. Finally, the estimated turn around time of 10 minutes was characterized by a triangular distribution of 5 minutes minimum, 10 minutes most likely, and 10 minutes maximum. These numbers are based on records for other hopper dredging projects that indicate the 10-minute turn is conservative.

Results of the risk analysis produce unit costs ranging from \$6.65 to \$9.04 per cy and can be compared to the current estimate of \$8.25. A contingency of 7.4% has been used in the current estimate and, applied to \$8.25, gives \$8.86. According to the risk analysis, there is a 96% level of confidence that the actual cost will be less than the fixed cost plus the contingency.

The above results are indicate that the selected contingency levels are reasonable and quantifies why the District has been successful with these contingency levels in the past. Furthermore, it should be noted that it is significant that the hopper dredge estimate is conservative inasmuch as the largest project costs are associated with hopper dredging.

With regard to the State of New Jersey's withdrawal of the disposal permit, the New Jersey Department of Environmental Protection (NJDEP) focused on the uncertainty of the project's economics based on the General Accounting Office's June 2002 report. Since the permit was originally issued in 1997, NJDEP requested the Corps to provide supplemental information to address its concerns, primarily with the project economics. Economic issues will be addressed in the ongoing economic assessment that was agreed to by the Corps and GAO. Once the report is approved by the Corps for release, it will be provided to NJDEP.

A specific NJDEP concern is related to Gloucester County, N.J.'s potential purchase of one of the three upland disposal sites that needs to be acquired for the project. Based on our recent research and coordination with the project sponsor, none of these three sites have been

purchased. However, if one of these sites becomes unavailable, a replacement site adjacent to the three proposed sites could be substituted. This action would have no appreciable impact to the overall project cost.

HEADQUARTERS ASSESSMENT: The action taken **resolves** the concern provided by the Review Panel. If one of the New Jersey sites becomes unavailable, a replacement site adjacent to the three proposed sites could be substituted. This action would have no appreciable impact to the overall project cost.

8.0 QA/QC PROCESS REPORTS

8.1 LACK OF QC PROCESS DOCUMENTATION

Statement of Concern. The implementation of the QC plan remains largely undocumented, and the review panel could not determine what actual QC steps were taken.

Basis of Concern. The QC plan as described appears adequate, but there is little documentation on how the plan was carried out or what changes were made as a result. It is also not evident which report materials were prepared by DMA and which by the Corps. Many of the critical features of the analysis have no documented audit trail

Significance of Concern. Given the multiple, fundamental concerns raised regarding the benefits analysis, the QC plan may have been ineffective, regardless of how good the plan looked on paper.

Specific Actions Needed. Creating confidence in the quality of the analysis requires more than just an appropriate plan. There should be some evidence that the plan was actually carried out and that the anticipated quality control steps were actually taken.

Applicable Corps Guidance. EP 1165-2-1, paragraph 7-1.b.

Corps Response:

A detailed documentation of the QC plan and QC process during the report preparation has been developed as part of the study effort. A copy of this report is attached.

Panel Conclusion:

As noted elsewhere, a major difficulty encountered in the review process has been that 1) the project report, 2) the model spreadsheets, 3) the model documentation, and 4) the QA/QC reports are all “out of synch” due to their successive revision in a tight timeframe.

- The latest iteration of the QA/QC report still contains responses to HQUSACE comments that have not yet been implemented.
- The spreadsheet audits described in the report are now outdated, and do not cover all the current model spreadsheets (also noted below).
- In several instances, report text does not match the current model methodology or assumptions.

Substantial work will be required to update the QA/QC report thoroughly, and to verify that all of the report and model modifications and revisions suggested in this review document and in the QA/QC report itself have been correctly implemented in the documents and models.

ACTION TAKEN (NAP 12/06):

The QA/QC process for the final report has verified that all report and model modifications suggested in the external review document have been correctly implemented and reviewed. The model and report documentation are now “in sync”. The QA/QC documentation is current through the December 2002 Final Report and is available for reference as a stand-alone document on both the Corps website and in hard-copy form.

HEADQUARTERS ASSESSMENT:

The action taken during the QA/QC process for the final report **resolves** the concern expressed by the Review Panel.

8.2 SPREADSHEET AUDITS

Statement of Concern. Previous spreadsheet audits were apparently ineffective, as the review team located serious problems with the prior versions of the models. Many of those problems have been corrected, but minor problems may still persist. The review team has not yet had sufficient time to review the latest spreadsheet models and the QC reports in detail.

Basis of Concern. The spreadsheet audits basically *describe* the spreadsheet models without determining whether or not the underlying analysis is correct.

- The audits accepted the practice of manually entering formula results instead of linking, which has the potential to introduce serious errors as spreadsheets are modified in successive model versions.
- Despite an extensive discussion of Conversion Factor Barrels Per Metric Ton on page 4 of the Supplement to the DMA QC Report of September 24, the issue identified in item 6.7 above persisted. The conversion factor was not properly

documented or justified, and the model documentation does not match the model in practice.

Significance of Concern. The spreadsheet models are the basis for all benefits estimates.

Specific Actions Needed. A “reality check” is needed as well as a cell-by-cell review. Spreadsheets should be reviewed for:

- Adequate, relevant and complete documentation.
- Substantiation and sourcing of assumptions and input factors.

Applicable Corps Guidance. ER 1165-2-1, paragraph 7-1.b.

Corps Response:

The models have now been linked and manually copied entries have been eliminated. As stated in the response to Comment 6.7, the country specific conversion factors have now been applied to the per barrel lightering charge. Additional documentation will be prepared for the final spreadsheet models, including the sources of assumptions and input factors.

Panel Conclusion:

A brief review of the October 30th versions of the spreadsheet models indicates that most of the proposed improvements have been made. Other improvements discussed at the November 4th meeting, however, are still pending, such as the removal of outdated fleet information. Audits should be completed for the numerous spreadsheets not covered by the original audits (such as in the Bulker model) or added since. At the November 4th meeting it was also suggested that flow charts be prepared to help document the methodology inherent in the spreadsheet model structure. Such steps are time-consuming and tedious, but are necessary to insure the validity of the models, facilitate sensitivity analysis, and provide for future modifications and refinements.

ACTION TAKEN (NAP 12/06):

QA/QC Audits have been accomplished for the revised model calculations discussed at the 4 November 2002 meeting. The September 2002 QC report, which was prepared prior to external review, contained initial details on the methodology and model runs. Flowcharts are a valid request however, the December 2002 QC report now contains an extremely detailed cell-by-cell description of what has been done to the models since the September 2002 reanalysis report and how the analyses were verified. These details should replace the need for the flow charts.

HEADQUARTERS ASSESSMENT: The action to develop the flowcharts will **resolve** the concern expressed by the Review Panel.

8.3 LACK OF DOCUMENTATION OR AUDIT TRAIL

Statement of Concern. Despite references to documentation in the Quality Control reports, documentation of the reanalysis report is seriously deficient, and the review panel has been unable to establish audit trails for critical factors in the analysis.

Basis of Concern. The District QC Report notes:

“In addition, as part of the DMA contract a Quality Control Plan (QCP) was developed to guide efforts on the Comprehensive Economic Reanalysis Report. The QCP involved review and validation of data, assumptions, models, analyses and documentation of the reanalysis effort.”

This Quality Control Plan was apparently not enough to insure that the report contained sufficient documentation and backup data to inspire confidence in the analysis and its findings.

The review team has not seen documentation of the QC program itself. The QC reports refer to memoranda, minutes, etc. on file but these were not provided for review.

Significance of Concern. Lack of documentation or audit trails might be considered the single greatest concern of the review team, since it erodes confidence in the entire benefits analysis.

Specific Action Needed. Since the review team has not seen any account of the steps under the DMA QC Plan, it is not possible to say how that plan should have been changed. One possibility, however, is that standards for report documentation should be raised. Another possibility is that external review should occur earlier in the process.

Applicable Corps Guidance. ER 1105-2-100, paragraph 4-4.

<u>Corps Response:</u>
As part of the study effort a QC report was prepared. A copy of this report is attached.
<u>Panel Conclusion:</u>
As noted above, it has become apparent that many of the seeming QA/QC process shortcomings were due to the compressed reanalysis timeframe. Under such circumstances, it is not surprising – although still not acceptable – that project documentation of all kinds should lag. The project team will have to bring the project report, the spreadsheet models, the model documentation, and the QA/QC report into agreement and conformity to complete the process.

ACTION TAKEN (NAP 12/06):

The QA/QC process has brought all elements of the analysis into agreement and conformity for the final report submission. The QA/QC process and results are presented in a stand-alone document available on both the Corps website and in hard-copy form.

HEADQUARTERS ASSESSMENT:

The action taken **resolves** the concern expressed by the Review Panel.